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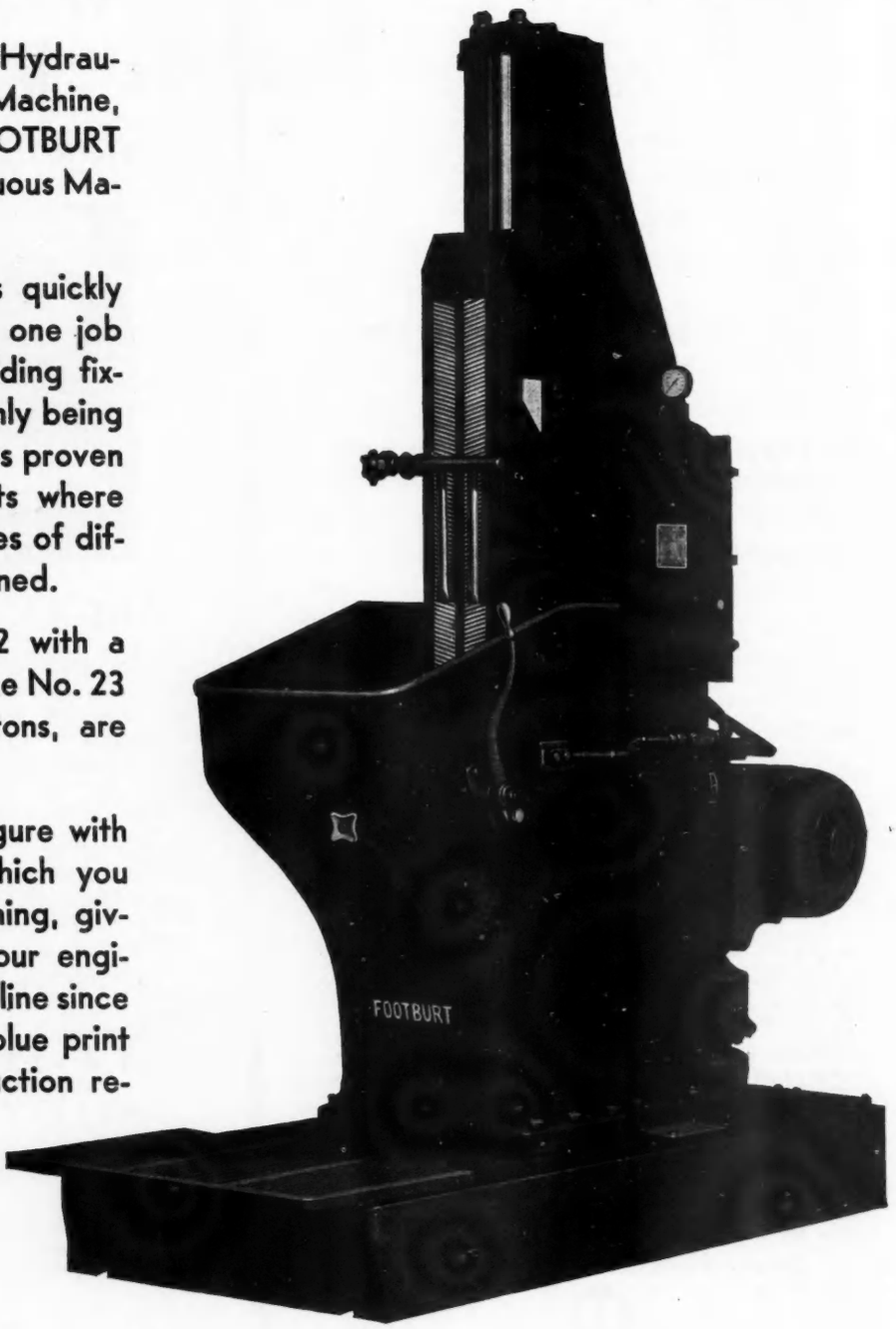

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AUTOMOTIVE INDUSTRIES

Vol. 72, No. 16 ▫ THIRTY-SEVENTH YEAR ▫ April 20, 1935

Weather Hampers Retail Sales

Makers Expect Good Business in Summer and Last 6 Months

by Harold E. Gronseth
Detroit News Editor, Automotive Industries

Unfavorable weather conditions last week halted the upward climb of automobile retail sales which have been expanding quite steadily since the first of the year.

While deliveries were maintained at levels well above a year ago, available weekly reports of sales showed that some irregularity had developed which sales executives ascribed to the unseasonable cold and to snow and dust storms which swept over a large part of the country.

Despite retail activity already in evidence spring buying is not considered to be in full swing as yet and the industry has its eyes fixed on May as the big buying month although there is a good chance that the peak may not be reached until out in the summer. During the past two years July has been the best month for sales. In 1932, it was June. In five of the last 10 years the peak was reached in April and twice during that period May was the best month.

There is a strong opinion that sales will be maintained at a high level well into the summer and that exceptionally good business will be experienced in the last half of the year. Two national automobile shows and two new model seasons in a single year should do much to raise the 1935 volume of sales and production.

Added to this will be the impetus of the government's huge spending program, which is certain to influence sales, particularly in the last six months of the year when the program should be well under way. News of the approximately five billion dollar appropriation for work relief automatically stimulated business, sales official reports.

It has been the experience of the industry that government spending programs are reflected in expanding sales. It happened when bonus money was made available to ex-service men, when PWA and CWA funds were flowing and when crop reduction checks went out. In fact, the big sales increases in many rural sections can only be accounted for by government money. Strong demand frequently has come from agricul-

(*Turn to page* 534, *please*)

Robert F. Black
New White President

Touring Sedan Added to Packard 120; List $1095

Packard is introducing a five-passenger touring sedan, a new body model in the 120 line listing at $1,095. It has a large built-in trunk. Below the trunk compartment is a hidden recess for a spare tire and wheel and for tools. Interior dimensions of the car are the same as in the five-passenger sedan.

Two 7 Passenger Sedans Added to Plymouth Line

Plymouth Motor Corp. has added two new 128-in. wheelbase models, a de luxe seven-passenger sedan and a de luxe Traveler sedan, each listing at $895. The Traveler model has built-in trunk. The cars have overall lengths of 200 in.

U. S. Air Corps Officer to Address Detroit SAE

Carl F. Greene, Captain, U. S. Air Corps, Wright Field, will address the joint section and student meeting of Detroit Section S. A. E. April 22 on "Aircraft Structures and Their Influence on Other Engineering Design."

William B. Stout, president S. A. E., will speak on "Aircraft Design Applied to the Automobile," flying to Detroit from the West where he is visiting the various sections, especially for the Detroit meeting.

Black Elected President of White Co., Report Piroomoff Will Head Brockway

At the first meeting of the reorganized board of directors of The White Co., in Cleveland, Robert F. Black was named president and A. G. Bean, chairman of the board. Mr. Black will assume the office on May 1.

The Brockway Motor Truck Corp., of which Mr. Black has been president since late in 1930, is scheduled to hold a board meeting on Friday of this week, and it is reported that George S. Piroomoff will be elected president. Mr. Piroomoff, as vice-president in charge of engineering, was Mr. Black's right-hand man.

Mr. Black has been associated with the truck industry almost a quarter century. He was vice-president of the Mack company before becoming president of Brockway. There Mr. Black found Mr. Piroomoff, who had left the White Co. in 1927 to become chief engineer of Brockway, and who designed a new line of Brockway and Indiana trucks which has enjoyed marked success.

The White board was elected last March when the company was separated from the Studebaker Corporation, but organization was delayed until this week. W. King White, Cleveland Tractor Co., president, and a son of one of the founders of the White Co., also was mentioned as a possible president. He is a member of the directorate.

Amended Eastman Bill with Truck and Bus Operator Backing, Gets Senate OK

Backed by the American Trucking Associations, Inc., and the National Association of Motor Bus Operators in its amended form, the Eastman Bill, S. 1629, providing for the Federal regulation of interstate motor carriers, was passed by the Senate this week without a record vote.

In the House, the Bill is still being considered by a sub-committee of the Commerce Committee but the ATA believes that a report on it will shortly be forthcoming. The trucking organization anticipates, however, that the Bill reported by the sub-committee will be radically different from the one passed by the Senate. If the House passes the Bill as reported by its committee, it will have to go to conference with the possibility that the resulting draft will have to go before both houses again.

The pessimism regarding the passage of the Bill by this Congress, reported as existing among automotive groups in last week's issue of *Automotive Industries*, has been dissipated somewhat by the favorable Senate action. However, there are still doubts as to its fate and it is felt in some quarters that active support by the President will be necessary to bring action. On this point, the ATA says that informed Washington observers feel that "the fate of the legislation . . . is largely dependent on the attitude of the White House. While transportation legislation is on the secondary 'must' program of the President, no definite information has been forthcoming from the White House that the President ardently desires the passage of the Eastman transportation plan."

The support of the trucking industry is conditioned on the passage of another bill in the Eastman program providing for the reorganization of the Interstate Commerce Commission and the setting up of a separate division in it to regulate motor carriers. Due to the fact that Senator Wheeler conceded the need for a separate division for motor carriers, there is considerable hope that the reorganization bill will be reported next. The bus operators would have preferred a separate bill regulating their operations, but apparently are disposed to support the amended bill.

The Bill does not provide for any regulation of private operators except that the ICC is authorized to regulate the qualifications and maximum hours of service of employees and safety of operation and equipment of private operators in the event the Commission finds such regulation necessary. The provision in the original bill authorizing the Commission to investigate and report on the need for federal regulation of sizes and weights of motor vehicles, is retained in the amended Bill.

In the amended bill, trucking interests win their point that their organizations should participate in the administration of the legislation since the Bill now authorizes the Commission to cooperate with them. Under the revised Bill, both common and contract carriers may expand their equipment without applying to the Commission provided, of course, that the service to be rendered is within the limits of their certificate or permit. Joint rates are now permissive instead of mandatory.

A most important change liberalizes the Commission's rate-making powers. While the Bill as approved by the Senate still gives the ICC powers to fix maximum and minimum rates on complaints that existing rates are unduly preferential or prejudicial, there is a proviso that the paragraph in question shall not be construed to apply to discriminations, prejudices or disadvantages to the traffic of any other carrier of whatever description. This and other changes leads the Motor Bus association to say that the Senate Committee took "every precaution to see that the bill as written would regulate motor carriers in the public interest rather than in the interest of competitive transportation agencies."

Maryland Sales Tax Law Evasion Made Difficult

Automobiles are the only merchandise sold at retail in Maryland exempt from the 1 per cent gross retail sales tax which has been imposed by the General Assembly. The tax bill was passed to raise relief funds after all other revenue-raising measures were voted down in one of the two houses. Governor Harry W. Nice has signed the bill.

Cars were not exempt in the original bill, but a separate measure was passed granting dealers the exemption. However, a 1 per cent tax on the cost of a car will be collected, for the bill which grants exemption to dealers imposes a 1 per cent titling tax which will have to be paid before the Motor Vehicle Commissioner's office will register the car.

Automobile dealers have pointed out that not only will the bill serve as an incentive to purchasers to not go out of the state to avoid payment of the tax but also it will increase revenues because it applies to automobiles purchased by non-residents and registered in Maryland. Under this provision it appears that Marylanders would be liable to the tax in any event should they seek registration within their home state for a car purchased elsewhere.

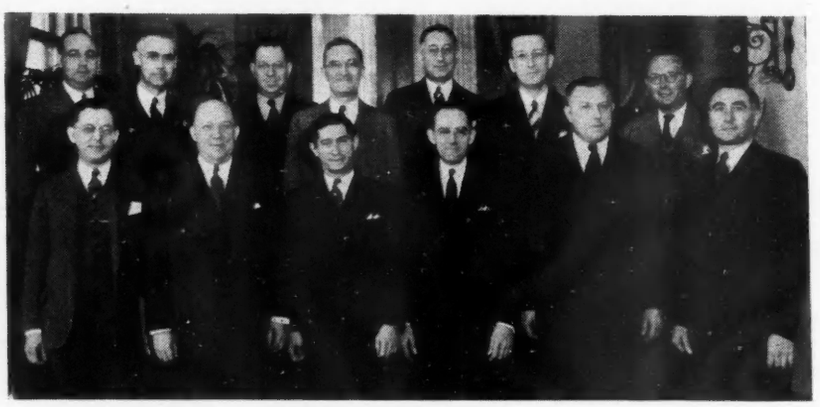
Union to Ask Contract at Chevrolet Toledo Plant

With employes of the Chevrolet Motors Ohio Co., Toledo, expected to give a clear majority to the Automobile Workers Federal Union No. 18,384 in their final election under the Automobile Labor Board, officers of the union have prepared a contract calling for increased wages, recognition of the union and some changes in working conditions.

Fred Schwake, business agent of the union, was nominated in each of the eight districts in the Chevrolet plant to represent the workers. The Chevrolet plant at Toledo is said to be the only one in the automobile poll which has given the A. F. of L. a clear majority on the first vote.

Plan Testimonial Dinner for Studebaker Officials

South Bend, April 20.—Plans are being completed for a civic testimonial banquet on April 26 to the officers and directors of the Studebaker corporation in recognition of their success in the reorganization of the company. President Franklin D. Roosevelt has been invited, and Governor Paul V. McNutt has signified his intention of attending.



The Joint Operating Committee of the Automotive Service Industries Show. Front Row, left to right: W. H. Richardson, Timken Roller Bearing Sales & Service Co.; H. A. Lightner, DeLuxe Products Corp.; Joe Fischer, Auto Parts & Gear Co.; C. P. Brewster, K-D Mfg. Co.; J. M. Spangler, JOC Chairman, National Carbon Co.; F. P. Rudy, Kenosha, Wis. Second Row, left to right: W. B. Carroll, Syracuse Auto Parts, Inc.; L. G. Matthews, JOC Vice-Chairman, Sealed Power Corp.; Herbert Buckman, JOC Secretary; A. B. Coffman, Show Manager; F. P. Gaul, Gaul, Derr & Shearer; G. W. Sherin, E. I. duPont de Nemours; W. R. Crow, Crow-Burlingame Co. Absent: B. S. Arnold, Onondaga Auto Supply Co. The show will be held at Atlantic City, Dec. 9 to 13, this year

GM Forming Plans For Altering Durant Plant

Present Occupants Given Moving Notice; All New Machinery to be Installed

Officials of General Motors, Fisher Body and the Olds Motor Works are moving swiftly with their plans for expansion of the Oldsmobile production facilities following the purchase of the Durant Motor plant at Lansing.

Plans were discussed in Lansing following the deal and several groups now occupying space in the Durant plant were notified to vacate within 60 days. Officials said they would start work immediately on the conversion of the idle factory for its new capacity as home of Fisher bodies for Oldsmobile.

A group of General Motors officials visited Lansing and made a complete inspection of the property. Most prominent in the group were A. J. Fisher, vice president of General Motors; E. F. Fisher, general manager of Fisher Body, and Tom Archer, manufacturing manager of Fisher Body. They were accompanied on their tour of inspection by seven Fisher Body engineers.

The officials from Detroit were accompanied through the newly acquired plant by C. L. McCuen, president and general manager of the Olds Motor Works, and George C. Paterson, manager of the Lansing Fisher unit.

They announced that all new machinery would be installed. Several months' time will be required to effect the new set-up, since it is the desire of Oldsmobile to carry out the entire expansion without disturbing the present record-breaking production schedule.

Car Makers Buy More Newspaper Space Than Any Other Class of Advertisers

Automotive manufacturers bought more newspaper space than any other class of advertisers last year, their linage purchases amounting to 34 per cent above the figures of 1933. Tobacco products ranked second, and groceries third.

A compilation of the 300 largest advertisers in newspapers for 1934, prepared for Printers' Ink by Media Records, Inc., reveals General Motors as first in the automotive list, with a total of 19,401,104 lines; Ford second with 9,660,719; Chrysler third with 8,469,457.

Of the 300 leading advertisers, 50, or 16 2/3 per cent, were automotive. But these automotive advertisers accounted for more than 80,500,000 lins of advertising, or more than 28 per cent of the total linage.

In the compilation, each corporation is listed as a single advertiser, regardless of the number of companies under its banner. The 300 listed advertisers, as a fact, represent 821 individual accounts. Of these 103, or a little better than 12½ per cent, are automotive.

Considering the separate automotive accounts, the Ford passenger car led with 8,302,111 lines; Chevrolet was second, with 7,887,860 lines; and Plymouth third with 3,118,217 lines. And these three passenger cars stood fourth, fifth and seventh in the complete lineup, Chesterfield cigarettes leading the procession with 17,103,046 lines; Lucky Strikes second with 15,475,371; Camels third with 15,397,399; and Lux toilet soap sixth with 3,424,961.

ALB Issues Rules and Instructions for Industry's Bargaining Agencies

To guide both the bargaining agencies and the managements in making the arrangements necessary to the fair and effective operation of the machinery of collective bargaining, the Automobile Labor Board on April 13 issued a statement of rules and instructions.

The statement says it is the duty of both parties to deal fairly and sincerely with each other and to make the industry's system of collective bargaining work. The purpose of such bargaining is "by negotiations to find the best balance between the economic requirements of the business and the just aspirations of the employees."

The rules provide for the members of bargaining agencies to hold office for one year or until their successors are elected. The intention apparently is to hold elections annually. Members of an agency may be recalled by the majority vote of their constituents. Employers may pay members of the agency for time spent in connection with its activities.

At the time these rules were issued 48 bargaining agencies had been selected and it was predicted by the middle of May 20 additional ones will have been named. These agencies will represent about 180,000 employees in the automotive industry. The Board and its agents have already met with many of the bargaining agencies, and have conferred with them and with employers concerning the methods of facilitating collective bargaining.

Dr. Leo Wolman
Chairman of the Automobile Labor Board

The rules and instructions issued by the ALB follow:

I. Rules

Elections:

1. Members of the bargaining agency shall hold office for a term of one year following the date of the general election in the plant and until their successors are elected.

2. Future elections shall be held in the plant under proper safeguards for secrecy and freedom of choice.

3. In the case of vacancies in the office of elected representatives, new primary and final elections in the districts in question will be promptly held by the election officials of the Automobile Labor Board.

4. Petition by a majority of the eligible voters in any district for the recall of elected representatives shall create a vacancy.

5. The existing election districts shall be subject to adjustment by the Board after consultation or hearing.

6. Employees such as foremen, sub-foremen or group or gang leaders who act in a supervisory capacity will not be eligible to vote.

All employees in any district working on the day of the election and all other employees in the district in Classes B, C, and D of the Board's rules of Seniority of May 18, 1934, as amended, will be entitled to vote in these elections.

Representatives:

1. Representatives will not be restricted to employees.

2. Representatives designated as members of a bargaining agency to complete proportional representation will not represent employees in any district but will serve as members of the bargaining agency on equal terms with all other members.

3. In cases where the area of the district is large or separated, the elected representatives may by arrangement with his constituents and with the employer provide for assistants.

4. It shall not be regarded as a breach of the Board's Rules of Lay-off and Rehiring to continue a representative in employment so long as a substantial number of his constituents still are at work.

5. It is proper for employers to pay representatives their usual hourly earnings for time spent during regular shift hours in

(Turn to page 532, please)

NADA Charged with Do-Nothing Policy on Factory-Dealer Relations Problems

In a letter headed "Crisis Approaches as NADA Sits Idly By," which went out this week to all NADA directors, chairmen and vice-chairmen of state advisory committees, association executives and others, George McFarland, chairman of the Pennsylvania code advisory committee and first vice-president of the NADA, charges NADA leadership with adopting a do-nothing policy on factory-dealer relations while "financial ruin stares thousands of dealers in the face. . . ."

"It is becoming increasingly apparent to me," Mr. McFarland says, "that the 'do-nothing' policy of the NADA on factory-dealer relations will continue just as long as the dealers permit it to continue.

"However, many dealers who would privately applaud a leadership that fought fairly but aggressively for their rights dare not 'stick out their chins' publicly for fear of factory reprisals. The organization can do it for them. Therefore, a proper question might be, 'Why don't they do it?'"

"What we need, and need immediately, is a leader," the letter continues.

Declaring that managing the NADA and the code authority, establishing better factory relations, watching legislation, etc., are too big a job for one man, the letter repeats a previous recommendation that a competent man be retained to devote all his time to factory-dealer problems. The need for factual data, such as the recent PAA survey, to support dealer contentions also is stressed.

Concluding, the letter asks that if the NADA does not propose to do anything, "Isn't it about time the dealers of the United States were told the truth? We will have to give full publicity to the pitiful plight of the dealer shortly if NADA doesn't do it. Placing a copy of the 32-page PAA-Payton survey in the hands of all bankers might assist in convincing factories that it might pay them to 'ride along' on the MVRT code; more gross profits and a more careful selection and appointment of dealers, although this should only be done as a last resort."

Union Taxes New York's Breakfast

A New York teamsters' union has taken a hand in the competitive battle for traffic between railroads and trucks. On all egg shipments coming into the city by trucks, it has recently been levying a tax of seven cents per crate, the money being used, the New York *Times* says, "to raise funds to provide members deprived of jobs as a result of the increasing trend to ship eggs into the city by truck instead of by rail." The union enforces the tax by refusing to let its members truck eggs from commission merchants who do not pay the tax.

The situation came to light as a result of protests from egg shippers who described the impost as a "racket." Not so the union contended, asserting that eggs were trucked from long distances at less than railroad rates, not only depriving the railroads of needed business but having the same effect on local truck drivers and truck owners, as the out-of-town trucks delivered their eggs direct to commission houses.

Chrysler Makes Sales Record in Jan.-March

Factory orders on hand totaling 102,041 cars and trucks, despite capacity operations, and first quarter retail sales by dealers in the United States of 159,265 units showing a gain of over 50 per cent over the same period of 1934 were the high lights of the news disclosed to stockholders of Chrysler Corporation at their annual meeting Tuesday when more than 65 per cent of the outstanding shares were represented, the largest representation in recent years.

W-O Elects AFL Agent in Sticker Campaign

In a last minute sticker campaign Fred Schwake, business agent of the United Automobile Workers Federal Union, won two out of the three district places in which sticker votes were counted in the final balloting by Willys-Overland employees Wednesday.

All candidates elected were labeled as unaffiliated. Out of a total of 1785 eligible voters and 1644 at work on election day there were 1158 votes cast.

Those elected in order by districts were Fred Bell, Louis I. Fleming, Albert Burkhardt, Fred Schwake, Walter Michalak, Norman Dopfer, William Marsh, A. J. Kane, Edson Kleinhans, and S. M. Soennichsen.

The Federal union which nominated Schwake in all of the eight districts at the Chevrolet plant in Toledo mailed to the management a proposed contract calling for a wage increase, seniority rights, and covering working conditions. The Chevrolet final balloting will be held next week, so that action by the A. F. of L. union was taken to indicate that it will claim it represents the workers regardless of the ballot.

Moorehouse, Morse Chain Automotive Div. Engineer

Alfred Moorehouse has been appointed chief engineer of the automotive division of the Morse Chain Co., a Borg-Warner subsidiary. Mr. Moorehouse will have his headquarters in Detroit. Formerly associated with Cadillac and Hudson, Mr. Moorehouse has been associated with the automotive industry since 1905. For 12 years he was chief engineer of Packard.

Alfred Moorehouse

In announcing the appointment the company said it was in line with the company's policy for advancing research development and application of timing chains together with other products allied to the industry.

Automotive Outlook Encourages Steel Men

Present Consumption Rate Indicates New Business; Price Increase Possible

With the volume of new business coming from automotive consumers running considerably behind the rate at which steel is being absorbed in current assemblies, confidence on the part of steel producers that considerable business overhangs the market is gaining from day to day.

Parts makers and body specialists, working up steel previously contracted for, without being in any too great a hurry to provide for replacement, say that visibility of the demand for their own products beyond May is not such as to afford them a clear picture to guide them in their buying policy. Steel sellers, on the other hand, have their eyes on the May 20-June 1 period of the calendar, the former date being the first day when third-quarter prices can be filed and the other that when books for third-quarter business will be formally opened.

Many are of the opinion that price advances will be in order and that, because of higher freight rates and conditions in general by that date, these advances will not meet with too strenuous resistance from buyers. The heaviest tonnage consumers among automotive buyers of steel, however, are expected to oppose any changes that would affect their closely calculated costs and selling prices. Some of the larger steel producers also continue to set their hearts more on a recovery of volume than on

Jan.-March Earning Statements

Car Companies	1935	1934
Reo	+ $10,612	— $272,881
Graham-Paige	+ 120,397	+ 15,141
Ford Motor Co., Ltd. (England)	+ 2,345,755	+ 3,599,742
Total—3 companies	+ 2,476,764	+ 3,346,002
Parts Companies	**1935**	**1934**
2 companies reported	+ $2,512,052	+ $1,452,123
Parker Rust Proof Co.	+ 317,507	+ 280,816
Eaton Manufacturing	+ 605,272	+ 341,151
Evans Products	+ 200,000	+ 504,279
Johns-Manville	+ 302,946	— 76,081
Allen Industries	+ 122,285	+ 68,565
Houdaille-Hershey	+ 902,869	+ 250,246
Seagrave Corp.	— 10,847	— 12,242
Total—9 companies	+ 4,972,084	+ 2,808,857

perhaps only temporary price advantages. And then there is the continuing uncertainty surrounding the code's fate at the hands of Congress.

If the jockeying for best position between buyers and sellers in the steel market leads within the ensuing four weeks to a moderate and gradual replenishment of stocks by automotive consumers, so as to come in under the wire before price advances can be chalked up, it is certain that no tears will be shed by steel producers. Meanwhile, the American Iron and Steel Institute's report for this week shows the first gain in the rate of ingot output in six weeks, 44 per cent of capacity being in operation as against 43.8 per cent a week ago.

Pig Iron—Automotive foundries continue to take in iron at the rate to which they have held in the last few months. Sellers are loud in their complaints that prevailing prices afford them but little more than cost and freely predict advances in the next quarter.

F.O.B. Prices Clarified by AMA for Export Line

To avoid misinterpretation of U. S. f.o.b. car prices by foreign buyers, a statement issued following a recent export managers' meeting of the AMA, emphasizes that: "It is important for the buyer abroad to realize that factory list prices for automobiles are in accordance with U. S. practices and are valuable for comparative purposes only. They do not include the prices of many items of equipment which are standard for U. S. trade, nor of other than standard accessories which are ordinarily required by American and foreign buyers."

As to trucks, the statement says: "List prices for standard chassis, without cabs and bodies, at factory—special and optional equipment supplied at extra cost."

Pontiac Promotes Olsen in Zone Personnel Shift

J. T. Bray, former assistant to the manager of the Atlantic region for Pontiac with headquarters in New York City, has been appointed manager of the Atlanta zone to replace A. C. S. Olsen, who is returning to take an important assignment in the central office at Pontiac. E. R. Pettengill, formerly office manager of the Detroit zone, succeeds Mr. Bray in New York. D. E. Reilly, former office manager of the Cleveland zone, replaces Mr. Pettengill at Detroit.

M. C. Thompson, former manager of the Pittsburgh zone, has been transferred to the same position in the New York zone, succeeding A. G. Swan, resigned. Mr. Thompson's Pittsburgh position is being filled by the promotion of A. R. Shedd, former assistant zone manager there. Clark Walker, former office manager in Washington, will be the new assistant zone manager at Pittsburgh.

Bates Assumes General Managership of Reo

Don E. Bates, re-elected president of Reo at the directors' meeting on Wednesday of this week, took over the additional duties of general manager. Other officers were re-elected.

A. Everly Carpenter

A. Everly Carpenter, III, secretary of E. F. Houghton & Company, oil and leather manufacturers, Philadelphia, died April 12 after a brief illness which culminated in pneumonia. Mr. Carpenter represented the fourth generation of Carpenters in that company which is now headed by his father, Major Aaron E. Carpenter, president. Mr. Carpenter was 29 years old.

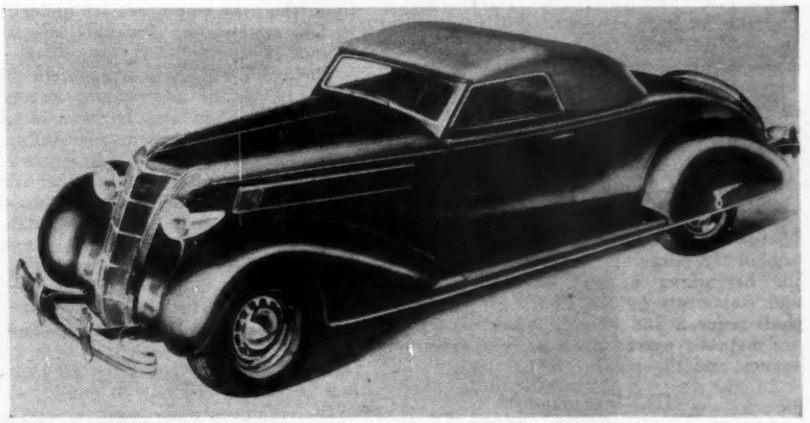
Bargainers Ask Access To Wage Records, Etc.

Would Also Fix Length of Layoff Constituting a Break in Seniority

The association of officers of collective bargaining agencies elected under ALB auspices in a letter to the Board has suggested that the following additional rules be incorporated in the Board's "constitution": That employees' representatives have access to wage and service records of constituents, determination of length of layoff which constitutes a break in seniority, a specific rule protecting employee representatives from discrimination at the hands of supervisors, and some arrangement to give flexibility to collective bargaining groups which have as many as 106 members.

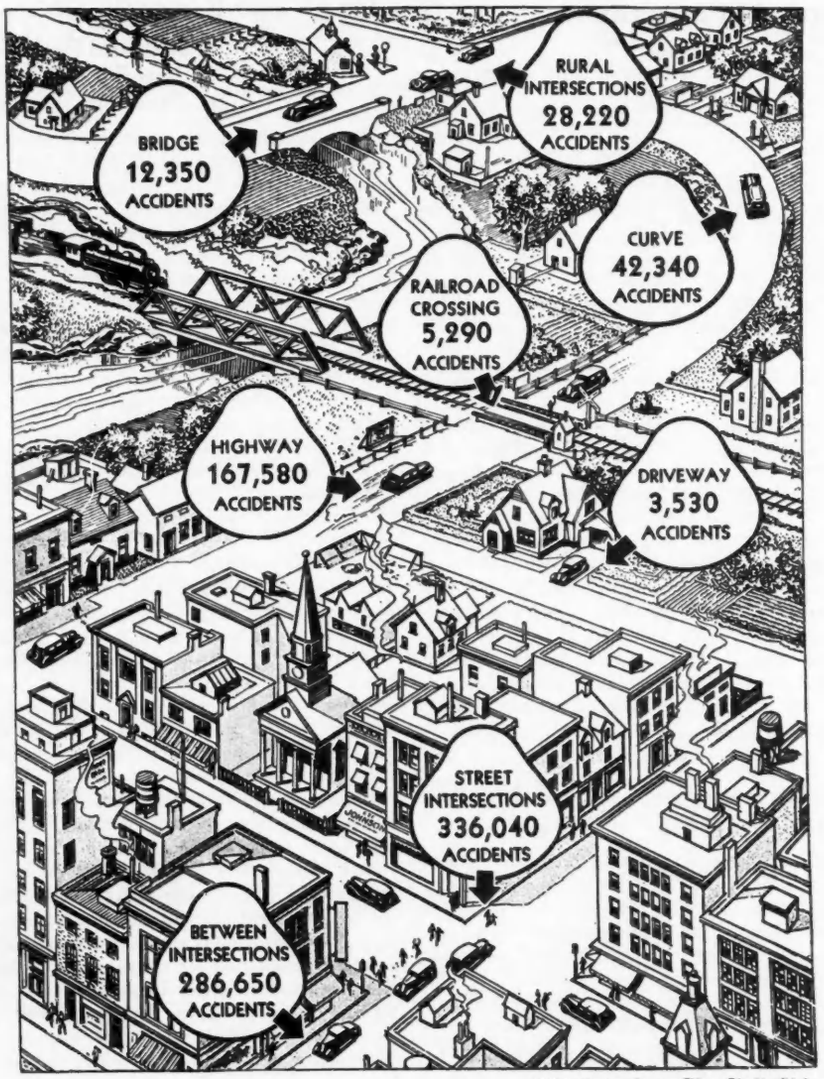
The Board does not plan to incorporate the Association's suggested rules into its "Constitution," taking the position that it attempted only to outline in a broad way the general procedure to be followed by the agencies without going into detail or laying down specific rules on many points which were certain to come up but which were to be left to be worked out in individual cases. Some of the points mentioned have been covered in a general way by the rules, a member of the Board stated, and the way has been left open for everything the officers' association seeks.

Divergent views on the regulations were expressed by labor leaders. Arthur F. Greer, president of the Hudson local of the Associated Automobile Workers of America, thought the rules "were fairly reasonable," but believed that each bargaining agency as far as possible should maintain its autonomy of organization and set up rules of its own. Matthew Smith, general secretary of the MESA, called the rules the "swan song of the Automobile Labor Board," expressing the opinion that the Board "lifted the rules from the preamble of any ordinary company union." He said it resolves itself down to competition between two company unions, one the official works council of the company and the other a Government sponsored company union. He specifically objected to bargaining representatives being on company payrolls.



A new convertible body will be available on the coupe model of the Chrysler Airstream Six for May delivery. It has the same X-type body frame built into the body which is described elsewhere in this issue in connection with the Plymouth convertible coupe. This new Airstream convertible coupe comes in several color combinations and lists at $870

Where Accidents Happen



1934 Data from The Shell Globe

ALB Issues Instructions

(Continued from page 529)

performing their duties as representatives and also for time outside of shift hours spent in meetings with the management held at hours fixed by mutual agreement or in performance of other duties as representatives agreed upon with the management. All such arrangements shall be subject to review and revision by the Board.

II. Bulletin Boards

The management shall provide bulletin boards for the posting of notices of meetings of the bargaining agency, of minutes of the bargaining agency, of such decisions and statements by the Board as the Board shall request, and of such other matters as are mutually agreed upon by the bargaining agency and the management.

III. Instructions

It is the responsibility of the employers and of the bargaining agencies to deal sincerely and fairly with one another, and to make the system for collective bargaining set up in the automobile industry work. The purpose is at all times by negotiations to find the best balance between the economic requirements of the business and the just aspirations of the employees. Both the employer and the employees are under the duty to find methods for amicably adjusting differences.

The employer shall arrange, by designating appropriate and qualified representatives, for prompt and fair consideration of the issues and arguments pertaining to the questions in negotiation. It is the duty of the employer, after hearing the arguments and giving them fair consideration, to reply promptly. It is ordinarily appropriate to accompany a decision with some explanation and, where possible, with evidence. Since the relation of employees to management is largely through the supervision of the plant, it is the responsibility of management to arrange that the supervision shall be informed of the methods of collective bargaining and that they shall conform to them.

The employee representatives and the bargaining agencies shall arrange for the prompt, orderly, and fair presentation of the just requests and grievances of their constituents. They shall keep their constituents informed of the status of questions with which they are dealing, and it is in this connection, proper for the employer to provide facilities for the meetings of the bargaining agencies and for the meetings between the representatives and their constituents. It is the responsibility of the representatives and of the bargaining agencies to assist in maintaining discipline in the shops and to select those cases and issues which in their best judgment are worthy of presentation to the management.

The bargaining agencies shall immediately following their elections choose their appropriate officers. As soon as this has been done, they shall confer with the plant managements for the purpose of agreeing upon simple rules of procedure for dealing with each other. These rules should deal with the relationship of the district representative to the immediate supervision, and with the relationship of the bargaining agency to the management. Such rules, when agreed upon, should be promptly filed with the Board.

Both parties to these agreements should make every effort to handle all questions before them swiftly and fairly. This can be best accomplished if the facilities necessary for the study of the facts relating to questions at issue are made available to the representatives and bargaining agencies, and the necessary contact is established between them and the appropriate representatives of the management, such as personnel officers and the like. It is the opinion of the Board that most questions can be settled on the ground. Both parties should exhaust every effort to adjust issues between the representatives and the lower supervision before the questions become the subject for discussion between the bargaining agencies and the representatives of the employers.

The Board has final jurisdiction over questions of discharge, discrimination, seniority, and representation. Individuals have the right to present their claims in respect to these questions directly to the Board. The prevailing arrangements, however, for collective bargaining between the bargaining agencies and the managements will be facilitated, and their success more rapidly assured, if cases are brought before the Board by the bargaining agencies after the procedure of negotiation in the plant has been utilized and, wherever possible, cases have been settled without reference to the Board.

Where the Board hears cases involving the discharge of employees who are representatives, representatives of the bargaining agency shall be present at the hearing.

The Board retains jurisdiction over all matters pertaining to representation and methods of collective bargaining.

Walker Co. Workers Return

The strike of workers at the Walker Manufacturing Co., Racine, Wis., was settled last week according to H. E. Scheck, federal mediator, who is reported to have announced the company had agreed to recognize the workers' union, an A. F. of L. affiliate. According to Malcolm McCormick, vice president of the company, wages were not an issue inasmuch as the Walker employees' scale is said to be well above the minimum prescribed in the code under which the company operates.

Hicks, Graham Director

Carl Hicks, treasurer of Graham-Paige, was elected a director succeeding Edwin M. Ashcraft, Jr., at annual meeting of stockholders last Monday.

New Hupp Contract Designed to Protect Dealers from Undue Competition, Losses

Preparation of a new form of contract has been announced by Archie M. Andrews, chairman of the board of directors of the Hupp Motor Car Company.

The contract, now being checked by the company's attorneys, will become effective in about four weeks. It will replace old agreements and serve as an instrument in all new dealer tie-ups.

Although the details have not yet reached their final form, the new contract, according to Mr. Andrews, will do away with the usual 30-day cancellation clause, and will extend the period of notice and include compensation arrangements.

Conferences are now being held to determine an equitable substitute for the 30-day clause. Present indications are that it will be not less than 90 days and no more than six months, depending somewhat upon the conditions surrounding the individual case. The compensation feature will probably call for the purchase by Hupmobile of the stock of parts and the taking over by the newly appointed dealer of the stock of new cars.

In explanation of the new policy, Mr. Andrews said in part:

"The basis of a sound merchandising policy is one of fair and effective co-operation between dealer and manufacturer. A manufacturer who merely solves the problem of production has still the problem of distribution to consider—and that problem depends for its solution upon adequate and loyal retail outlets. The dealer is and must be an integral part of his organization, not its victim.

"The object of the new contract is to create a spirit of mutual help, of family feeling instead of one of antagonism and suspicion. It is designed to foster compliance with the Motor Vehicle Retailing Code because we feel that this Code must be the basis of any solution of the many problems now faced by this industry and which, in my opinion, can be effectively enforced only with the sympathetic co-operation of the manufacturers.

"Above all, we see the dealer's problems. We recognize that he has large expenses. He must rent showrooms in a costly section of the city and bind himself to a long lease; he must invest in a stock of parts, of cars new and old. He is obliged before he sees any return to invest large sums of money and assume heavy obligations.

"In selling, he is constantly battling the evil of multiple dealers, particularly bad in the large cities. The practice of handing out dealer franchises to every Tom, Dick and Harry with a few thousand dollars and so, cluttering up the sales territory with competitors unable and frequently unwilling to provide the service the public demands is a canker that requires prompt and acid action.

"To accomplish this end, we propose to guarantee our dealer:

1. That his contract will be terminated, if at all, only after a period sufficient to enable him to retain his self-respect as a business man and to liquidate in such manner to prevent his sustaining undue losses.

2. That in case of cancellation by the manufacturer, his investment in parts and cars will be taken care of directly by the manufacturer or the dealers' successor.

3. That the manufacturer will share the losses entailed in the Fall close-out of obsolete models.

4. That his exclusive territory will be large enough to assure him a substantial profit; in other words, that there will be no excessive number of dealers franchised to sell the Hupmobile in his territory.

"In addition, I might add, the Hupp Motor Car Company will continue its aggressive direct-to-the-consumer advertising policy which has already produced such excellent results. We will continue to pay as much attention to mass consumption as we are to mass production.

"By contest tie-ups with manufacturers of food store and drug store commodities we have been able to enlist as dealer helpers and prospect finders an army of almost a million men and women outside the automobile business. These in turn have been helped by newspaper and magazine advertising devices on display in retail stores."

Railways and Highways

L. A. Rossman's "Railways and Highways" has just been published. It is a comparative study of the transportation problem and the attacks upon highway transportation made by the railroads. In his book Mr. Rossman cites the social advantages accruing from the development of the passenger car, bus and truck in the form of inexpensive transportation and refuting the often made charge that truck transportation has robbed the railroads of freight revenues. The author shows by the railroads' own statistics that more freight revenue has accrued to the railroads through the advent of the automobile than has been taken from it by highway freight transportation. Mr. Rossman is a newspaper publisher of Grand Rapids, Mich.

Fiat Orders Furnace from Detroit Electric Co.

Detroit Electric Furnace Co. has received an order from Fiat Motor of Torino, Italy, covering a thousand-pound Detroit Rocking Electric Furnace for use in Fiat's brass foundry.

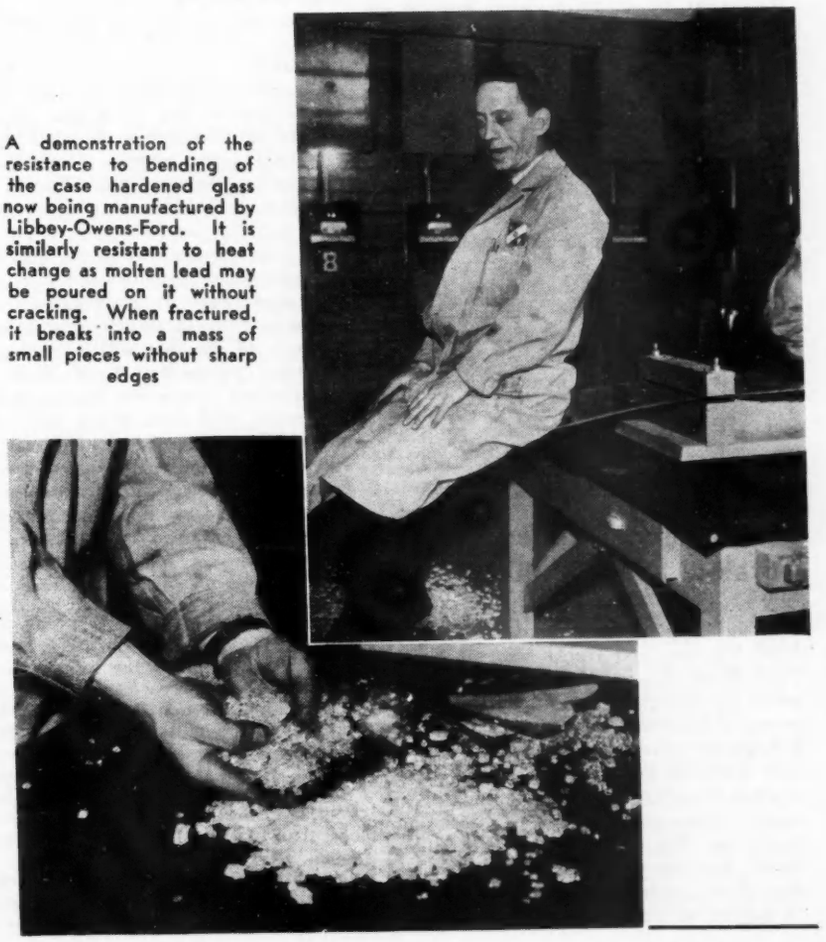
Eisemann Magneto Corp.

The Eisemann Magneto Corp. reports a net loss of $37,349 for 1934, which compares with a net loss of $131,532 for 1933. As of Dec. 31, 1934, the company's reported current position was:

	1934	1933
Current assets:		
(Inc. $58,110 cash)...	$828,432	$857,147
Current liabilities ...	27,259	41,280
Working capital	801,173	815,867

Doehler Die Casting Co.

The Doehler Die Casting Co. reports a net profit of $460,550 for 1934, which compares with $232,933 in 1933.



A demonstration of the resistance to bending of the case hardened glass now being manufactured by Libbey-Owens-Ford. It is similarly resistant to heat change as molten lead may be poured on it without cracking. When fractured, it breaks into a mass of small pieces without sharp edges

Hupp Gets $250,000 Private Loan Offer If Receivership Petition is Dropped

A loan of $250,000 has been offered Hupp Motor Car Corp. by an undisclosed individual contingent upon dismissal of a receivership petition now before Judge Edward J. Moinet in U. S. District Court, it was disclosed by Hupp counsel at court hearings Tuesday.

Efforts during a week's adjournment of the hearings on the receivership petition and injunction proceedings against Archie M. Andrews, Hupp chairman, and several directors, brought by J. Walter Drake, one time chairman of the board, failed to bring the opposing factions into agreement.

Offer of Andrews to resign as chairman in the interests of harmony was made by his attorney, former Governor Alex J. Groesbeck, who, hopeful of composing the differences between the two sides, asked for further delay in hearings.

George L. Schein, New York counsel for Hupp, however, disagreed with his colleague and with the reorganization plan proposed by Frank E. Robson, Drake's counsel. Robson's plan was to form a new board composed of nine members, three to be appointed by Andrews, three by Drake, and three by creditors. Schein objected to both proposals because of the time element involved, explaining that immediate action was necessary on the loan and on arrangements with parts suppliers who were to meet Wednesday to determine what position to take on the question of extending credit.

Subsequently Mr. Groesbeck suggested a compromise board of nine members, six of whom would be chosen by the company, J. Walter Drake, stockholder who instituted the court proceedings, and by parts suppliers, and the remaining three to be chosen by Judge Edward J. Moinet, before whom hearings are being held. Parts makers had earlier proposed they be given five members on the board.

It was indicated at the hearings that the company does not have sufficient cash to continue operations much longer, but that outside loans might be secured in the near future if parts makers would continue supplying the company during the interval under a new board. Conferences are being resumed as *Automotive Industries* goes to press.

Ford March Purchases Totaled $81,000,000

A new high record of purchases of materials and supplies for use in manufacture of Ford V-8 cars and trucks was set by the Ford Motor Co. in March when disbursements for materials and supplies totalled in excess of $81,000,000. The former high was $78,000,000, which was in April, 1930.

In addition, Ford payrolls during March totalled $16,500,000. Before the end of the month, production of Ford V-8 cars and trucks in 1935 will pass the half million mark. Late last year Henry Ford announced that Ford production in 1935 would be "a million or better."

Sales of Ford V-8 cars and trucks through April 10 this year exceeded total sales in all of 1932. Sales between January 1 and April 10 totalled 334,437 cars and trucks. This compared with total sales of 328,607 cars and trucks in all of the year 1932.

A. Van Der Zee, general sales manager of Dodge, announces the appointment of P. A. Jerrue to the post of manager of the St. Louis region of the Dodge sales organization.

GM Parts Corp. in Operation

Parts and accessories for Chevrolet, Buick, Oldsmobile and Pontiac cars are now being distributed by the General Motors Parts Corp., which has taken over the warehousing and shipping functions from the divisions. Sales promotion remains a function of the individual divisions. The GM parts subsidiary was formed well over a year ago, but it is understood that it has been functioning actively only in recent months. M. D. Douglas is reported to be in charge of its activities.

Weather Hampers Retail Sales

(*Continued from page* 527)

tural communities in off seasons when normally they would not be buying. One company reported that its dealer in a South Dakota town clamored for delivery of 17 cars in January, whereas in the preceding year he had delivered only 13 cars all year.

The marked increase in retail deliveries since recovery set in is considered to have made only a small dent in the huge backlog of replacement demand created during the depression years. It is estimated that there are more than 12,000,000 cars in use over six years of age that will be replaced with returning prosperity. Cash deals, which characterized automobile buying during the depression, still form a big percentage of automobile sales. Apparently many buyers still are unwilling to commit themselves to future obligations, which means that with returning confidence time sales will augment volume still further.

Retail sales of 5630 Oldsmobiles in the first 10 days of April established another new high mark, 78 per cent in excess of deliveries in the first 10 days of April, 1934. To date this year, deliveries total 38,992 cars, well over three times the volume for corresponding period last year.

Pontiac retail deliveries for the first 10 days of the month jumped to 5126 from 4404 in comparable period of preceding month. In the Detroit zone, which embraces Michigan and parts of Ohio and Indiana, Pontiac dealers already have delivered more cars than in all of 1934, when their total was 4532. It is the first Pontiac zone to attain that distinction. At the factory, capacity operations continue, with prospects good for reaching an output of 19,000 cars this month and a retail sales goal of 18,000 cars. Production hit the 1000 mark April 10, and for week ended April 13 totaled 4407 cars.

Dodge dealers delivered 7058 Dodge and Plymouth cars and 1302 commercial cars and trucks during week ended April 13, compared with 8014 cars and 1300 trucks in the preceding week, although an increase of 2842 units, or 51.5 per cent, over corresponding week last year. In the first 15 weeks this year Dodge dealers delivered 81,395 cars and 13,978 trucks, a total of 95,373 vehicles, or an increase of 57.4 per cent over the 60,608 units delivered in corresponding 1934 period. Deliveries of used cars and trucks by Dodge dealers during the week of April 13 totaled 7810.

Plymouth's new car deliveries during week of April 13 totaled 9545, more cars than were delivered in any week last year and exceeding the corresponding 1934 week by 29 per cent. To date this year Plymouth deliveries total 106,903 cars, against 74,499 in like period last year, a gain of 43.4 per cent. Plymouth factories in Detroit and Los Angeles are being kept on capacity schedules. Used car sales by Plymouth dealers during week ended April 6 totaled 17,000.

Chrysler dealers during week ended April 13 delivered at retail 3766 Plymouths and 1078 Chryslers, a total of 4844 cars, against 4941 cars in preceding week. Compared with the week a year ago, Plymouth showed a gain of 22.2 per cent, while Chrysler deliveries were up 40 per cent. In the first 15 weeks of this year Chrysler dealers delivered 40,993 Plymouths and 10,790 Chryslers, a total of 51,783 units, which was an increase of 59.4 per cent over the corresponding week of 1934. These figures do not include deliveries by DeSoto and Dodge dealer bodies.

Retail sales of all Chrysler-made cars in the first two weeks of April were 34,852 cars and trucks, against 26,633 a year ago, increase of 31 per cent.

Cadillac-LaSalle reports unfilled orders of over 3000, despite a sharp increase in production and a jump in factory employment during the last two months of 61.3 per cent. Retail deliveries for the year to date are up 69.2 per cent over like period of 1934. The factory has signed 107 new dealers since the first of the year, and of that number 65 joined during the first two weeks of April.

Studebaker Corp. has scheduled more than 6000 cars for April production, against 5300 turned out in March, and reports retail sales expanding, stimulated by last month's price reductions.

Nash Motors plans to turn out 4500 cars in April, compared with an output of around 4200 cars in March.

Hupp is producing 80 cars a day and has orders on hand for 2500 cars.

Registrations of new passenger cars for March amounted to approximately 260,000, as compared with 173,287 a year ago and 170,615 during February of this year, according to estimates based on returns from 24 states. Actual registrations in the 24 states are 94,573, as against 61,301 in March, 1934, an increase of about 54 per cent.

New truck registrations for this same period amounted to about 41,000 units, as compared with 33,884 in March, 1934, and 34,797 during February of this year, according to estimates based on returns from 24 states. On this basis March will show an increase of approximately 21 per cent over the same period a year ago and 18 per cent over February, 1935.

On the basis of these estimates combined registrations of new motor vehicles was in the neighborhood of 301,000 units, the highest registration since April, 1931, and the best March since 1930. when 341,023 motor vehicles were registered.

Labor Board Sets April 23 as Date for Election at Kelsey-Hayes Plant

The Kelsey-Hayes Wheel Corp., up to closing time for this issue, had not announced what position it would take with respect to the NLRB order directing that an election be held at its plant. The election has been scheduled by the Detroit Regional Labor Board for Tuesday, April 23. A court test of the order, however, is regarded as a possibility, in which case, of course, the balloting would not take place on the date set.

Meanwhile, if the election is held, the A. F. of L. apparently is girding for battle in a first effort to establish majority rule in an automotive plant in the Detroit area. The election is intended to determine whether employees desire to be represented by the United Automobile Workers Federal Union No. 18677 or by the association of the company's employees, into which groups the plant's 4000 employees are said to be fairly evenly divided.

Describing the proposed election as "historic and of utmost importance to the future welfare of the workers," A. F. of L. leaders in Detroit are preparing for a strenuous campaign and have pledged to employees of the corporation the resources of the Federation and the facilities of the local office.

A statement issued from the office of F. J. Dillon, general organizer for the A. F. of L., traced developments which led to the appeal to the National Labor Relations Board. It stated that the Kelsey-Hayes local, which was chartered in July, 1933, had endeavored to negotiate with the management in an effort to establish collective b rgaining, but despite various conferences it had never been possible to establish a relationship which would permit the committee to function as a genuine bargaining agency. Failing to work out a satisfactory arrangement, the union local petitioned the Detroit Regional Labor Board on January 18 last for a Government supervised election under the direction of the NLRB. Hearings were conducted on this petition by the Regional Board on March 9, with a review by the NLRB April 3 and a decision handed down on April 10 ordering an election to be held within two weeks of the decision.

Mr. Dillon's statement charged that there is every indication that the Kelsey-Hayes Wheel Corp. will decline to cooperate with the Government in the conduct of this election and that the corporation will receive the assistance and support of employers generally.

Perkins Negotiates Pact Averting Tire Plant Strike

The threat of labor troubles affecting 35,000 employees of the Firestone, Goodrich and Goodyear tire plants in Akron was removed this week when employers and the A. F. of L. ratified a settlement negotiated by Secretary of Labor Perkins.

Under the settlement, the management agrees to receive its employees or their representatives for the discussion of grievances, the elections ordered by the National Labor Relations Board are postponed pending the final determination by the courts of the issues involved, and meanwhile there are to be no strikes or lockouts except where either party refuses to abide by the decisions of a neutral board provided for by the settlement.

New Toledo Company Makes Automatic Starting Device

History may be repeating a little of its story in the announcement of incorporation this week of the Synchro-Start Corp. and its lease of space at 213 Cherry street, Toledo, O.

This new company, headed by W. J. Williams, Chicago, makes a device for automobiles which provides automatic starting from the moment the key is turned in the ignition system. The company is beginning in the same quarters used several years ago by the Electric Auto-Lite Co., when it began its operation in the field of electrical equipment for motor cars.

USCC to Consider Uniform Size, Weight Standards

Approval of the American Association of State Highway officials' uniform motor vehicle size and weight standards by the United States Chamber of Commerce will be considered on April 29 to May 2 at the annual meeting of the Chamber at Washington. The organization may commit itself for or against the uniform standards either by vote of member organizations through delegates at the annual meeting or by referendum.

Dr. Hill With Sun Oil Co.

Dr. J. Bennett Hill, formerly chief chemist, Atlantic Refining Co., is now located with the Sun Oil Co., at its refineries in Marcus Hook, Pa.

Engine Makers Experiment With Rotary Valve Motor

According to Joseph A. Anglada, consulting engineer, one of the largest companies in this country devoted to the manufacture of aircraft engines and one of the most representative organizations in the automobile field are endeavoring to increase the outputs of their engines by the use of a new type of valve action that will reduce the inertia forces in the engines and increase the volumetric efficiency. The firms referred to are experimenting with rotary instead of reciprocating valves. With the rotating valve it is claimed to be possible to open the intake more quickly, open it wider, and close it more quickly. The same principle can be applied to the exhaust.

Valpey, Graham-Paige General Sales Manager

F. R. Valpey, vice-president of Graham-Paige Motors Corp., has been made vice-president and general sales manager. A. I. Philp, vice-president in charge of sales, becomes assistant to J. B. Graham, president.

Hudson's Balance Sheet

The Hudson Motor Car Co.'s balance sheet on Dec. 31, 1934, showed total current assets of $8,276,311 against total current liabilities of $6,138,345, with a working capital of $2,276,311. Included in the company's current asset account was $2,386,153 in cash; $745,275 in accounts receivable; $4,562,045 in inventories at the lower of cost or market. The liability account showed $1,800,000 in notes payable; $3,125,369 in accounts payable, and $1,212,975 in accrued accounts.

Brockway Has 11 New Models in Production

Brockway now has in production 11 new models in the capacity range of 10,500 lb. to 18,500 lb. gross load rating to take the place of five models of like rating in its 1934 line.

Miller Building Ford Engined Racing Jobs

DETROIT — Harry Miller, famous race car builder, is constructing ten front-drive jobs here for the Indianapolis race. The cars will be powered with modified Ford V-8 engines. It is understood that Mr. Miller is being backed by a group of Ford dealers among others.

Burgess-Norton Announces Two New Starter Drives

Burgess-Norton Manufacturing Co., Geneva, Ill., announces the production of two new starter drives, fitting starter shafts of ¾ and 13/16 in. diameter. A still larger drive has been developed for original equipment on Diesel engines.

Reo Motor Car Co.

Reo reported a net profit of $10,612 for the first quarter at the annual meeting of stockholders held in Lansing on Tuesday of this week. This compares with net loss of $272,881 in the first quarter of last year and is the first time since 1929 that the company has reported a first quarter profit.

Hastings on Murray Board

C. D. Hastings, who at different times in the past was respectively chairman of the board and president of Hupp, has been elected a director of the Murray Corp. of America, succeeding F. A. Potter, Jr. Other directors were re-elected.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries

Trade continues to show signs of gains in some directions, despite the indifferent showing of several of the leading industries. Retail trade, in particular, seems to be responding to seasonal influences, although the weather in some important sections has been unfavorable. Wholesale trade has also exceeded expectations, with some dealers unable to make immediate shipments.

Late Easter Affects Retail Sales

Department store sales reported to the Federal Reserve Board increased from February to March by considerably more than the estimated seasonal amount. The board's index, which makes allowance for differences in the number of business days, for usual seasonal movements, and for changes in the date of Easter, was 80 in March, on the basis of the 1923-25 average as 100, compared with 75 in February and 72 in January. Sales in March were, however, smaller than a year ago by 8 per cent, reflecting the influence of the later date of Easter this year and also of the smaller number of working days.

Mercantile Co. Profits Up

Total profits of 659 leading industrial and mercantile companies whose statements have so far been published were 52 per cent larger for 1934 than for 1933, according to a compilation by the Federal Reserve Bank of New York. They were, however, only about one-third as large as in 1929. The gain over 1933 was due entirely to larger earnings in the first half of the year.

Coal Settlement Hits Car Loadings

The movement of railway freight dropped sharply during the week ended April 6. Loadings during that period totaled only 545,627 cars, showing a decline of 71,858 cars from the figure for the preceding week and a decrease of 13,433 cars from that for the corresponding period last year. The drop is attributed to reduced demand for bituminous coal with the passing of the strike threat in that industry.

Current Output Gains 5.2%

Production of electricity by the electric light and power industry for the week ended April 6 was 5.2 per cent larger than that a year earlier. This is the greatest gain over last year's corresponding figure reported since the week ended Feb. 16.

Crude Production Less

Average daily crude oil production for the week ended April 6 amounted to 2,536,000 barrels, which is 27,250 barrels below the level of the preceding week but exceeds the Federal allowable figure of 2,527,300 barrels, which became effective on April 1. Average daily output a year ago totaled 2,337,650 barrels.

Fisher's Index

Professor Fisher's index of wholesale commodity prices stands at 81.7 for last week, as against 81 the week before, 80.6 two weeks before, 81 three weeks before, and 81.7 four weeks before.

Federal Reserve Statement

Federal Reserve bank credit outstanding increased $1,000,000 during the week ended April 10. The monetary gold stock rose $46,000,000 and member bank reserve balances $94,000,000, while the amount of money in circulation declined $10,000,000.

Packard 120 Production Nears 1000 Cars Per Week

Demand for the new Packard low-priced car is up to the expectations of the management, Alvan Macauley of Packard Motor Car Co., told stockholders at their annual meeting. Production of this car is approaching the 1,000 car mark per week, 972 having been turned out the second week of April. The foreign market for the "120" is exceptionally strong, Mr. Macauley stated.

The company has doubled its dealer organization since the first of the year and is continuing to expand its sales outlets.

Referring to Packard's Diesel engine developments, Mr. Macauley said that the management had decided to hold this project in abeyance while concentrating on the job of bringing out a car in the new price field. He explained that there are some problems in Deisel engine large scale production that are rather difficult but will be worked out in time, pointing out that there is a demand for Diesel engines in about 20 different horsepowers, but that the cost of tooling plants for their production would be enormous. "Diesel engine use for airplanes is not yet sufficiently simplified and standardized, but that will come along. We are still adapted to large scale manufacture of airplane engines when the time comes," he says.

Old Workers Past 40 Make Up 28% of Force

More than 28 per cent of the employees at Oldsmobile are over 40 years old. This figure, based on a survey made of employment during the last complete production year, shows that the backbone of the Oldsmobile factory organization is composed of men who have been regularly employed by the Olds Motor Works for many years.

Oldsmobile, the survey reveals, is the only automobile manufacturing company to boast a "Quarter Century Club" composed of nine men who have worked as Oldsmakers for 25 years or more. It includes men who were Oldsmakers when the company was turning out the old curve dash models. More than 1489 men in the Olds plant are more than 40 years of age; 68 over 60 years and numbered among this group are nine men past 70 years, the survey revealed.

NYU to Offer Course On Streamlined Trains

A course on the basic aerodynamic and dynamic principles of streamlined trains and other high speed railroad equipment, believed to be the first ever offered in any engineering college, will be given this fall at the Daniel Guggenheim School of Aeronautics in the College of Engineering at New York University, it was announced last week by the director, Professor Alexander Klemin.

The Graduate School of the University will cooperate with the Aeronautical School in sponsoring the course, Professor Klemin said, which will be one of a group of courses leading to the degree of Master of Science in Aeronautical Engineering.

Professor Klemin has developed special wind tunnel equipment for testing the air resistance of high speed locomotives, automobiles and other vehicles which run on the ground, and the laboratory work of the course will center about this new equipment. A major feature of this equipment is the "moving ground" described in Automotive Industries of August 4, 1934.

March Freight Movement Sets Record at Ford Plant

All existing railroad freight traffic records at the Rouge plant of the Ford Motor Company were broken in March for the second consecutive month. Railroad freight movement through the Rouge plant yards in March totaled 34,955 cars (loads and empties), the company said. This was nearly 11 per cent greater than the former record of 31,500 cars handled through the Rouge plant yards in February.

The last previous high was a total of 29,500 cars which passed through the yards in April, 1930.

Employees' Assoc. Wins Chevrolet ALB Election

Thirteen members of the Chevrolet Employees' Association and three unaffiliated candidates were elected collective bargaining representatives at the first election held in the Chevrolet plant at St. Louis under the supervision of the Automobile Labor Board. American Federation of Labor members had been instructed to ignore the election and had no candidates in the field.

Reserve Banks Buy Hudson Notes Supplying $6,000,000 New Capital

Ample working capital for its expanding operations has been provided the Hudson Motor Car Company through sale of $6,000,000 of notes to Federal Reserve banks of New York and Chicago. The notes, which are secured by a first mortgage on the company's manufacturing properties in Detroit, mature in varying amounts from August 1, 1936, to March 20, 1940, and constitute the company's only funded debt. Hudson has no preferred stock.

The maturities are on the following basis: $250,000 on August 1, 1936, $500,000 on August 1, 1937, $750,000 on August 1, 1938, $1,000,000 on August 1, 1939 and $3,500,000 on March 20, 1940. The loan was arranged at par and there will be no public offering.

In announcing the loan, Roy D. Chapin, president, said: "Although Hudson has shown a substantial gain in working capital since the beginning of the year the large volume of business now being done makes desirable an increase in working capital. In addition to supplying working capital the proceeds from the sale of the notes will permit retirement of the short term notes now held by commercial banks."

Shipments of Hudson and Terraplane cars up to April 1, 1935, totaled 34,881 compared with 30,586 cars shipped to the same date last year. Shipments for week ended April 13 were the largest for any week this season and retail sales are steadily increasing, according to Mr. Chapin.

Coming on the heels of the Studebaker reorganization in which bankers participated to the extent of underwriting a $7,000,000 debenture issue, the new Hudson financing is further evidence of the faith of banking interests in the well managed "independent" and reflects as well confidence in the outlook for the motor industry in general.

Roy D. Chapin

Chile Not Importing Japanese "Datsuns"

The report that Japanese "Datsun" cars were entering Chile in considerable numbers is without foundation, according to Assistant Commercial Attache H. M. Randall, Santiago, in a report to the Commerce Department. None of these cars have been received in Chile, Randall states, nor so far as can be ascertained has any arrangement been made in the country for their importation.

Two German makes of small cars having low fuel consumption have recently been introduced into the Chilean market, the report shows, namely, the Mercedes Benz and the D. K. W. However, it is the consensus of opinion among local automobile dealers that the market is not favorable to a very light, short wheel base automobile. The roads are such as to make country travel very uncomfortable and even in the cities the paving as a rule is not sufficiently good to favor this type of automobile.

The Chilean automobile owner, the Commercial Attache states, for the most part is far more interested in the good performance and appearance of his automobile than in the economy of fuel consumption. For this reason it is very doubtful that the midget type of car will make any particular progress in this market.

Nash Foresees at Least Four Major Car Producers

"Come what may, there will always be at least four major producing organizations in this industry", Charles W. Nash said in a recent interview in response to a question of whether he thought the future would bring a thinning out of independent automobile manufacturing companies. "And I guess I hardly need say that we intend Nash Motors to be one of the four. A strongly established, well financed, long experienced independent who keeps his plants up-to-date and who manufactures a product of unquestioned quality and merit at prices pleasing to the public, need fear nothing now or in the future".

Mr. Nash also expressed his belief that the time is not far off when the industry again will experience the business volumes of 1928 and 1929. Mr. Nash expressed his opinions upon his return to his office from a trip to the Pacific Coast.

Vauxhall 1934 Profits Increased 73% Over '33

Vauxhall Motors, Ltd., General Motors' British subsidiary, had a very successful year in 1934. Total sales of cars and trucks amounted to 40,456 units, as compared with 27,636 in 1933, and profits amounted to £837,909 or about $4,000,000, which is an increase of 73 per cent over the previous year. At the recent annual meeting, at which these figures were made public, it was announced that an employees profit-sharing plan had been adopted, according to which 10 per cent of the net profits above 6 per cent on the capital employed would be divided among employees in proportion to their salaries. Employees become eligible to profit-sharing only at the end of their first year of employment by the company.

White Motor Co.

The White Motor Co. reports a net loss of $1,400,800 for 1934 which compares with a net loss of $3,413,573 for 1933. As of Dec. 31 the company reported its current position to be:

	1934	1933
Current assets (Inc. $2,508,085 cash)	$15,096,137	$16,783,848
Current liabilities ...	1,369,243	1,635,391
Working capital	13,726,894	15,148,457

Cleveland Graphite Co.

The Cleveland Graphite Bronze Co. reports a net profit of $510,803 for 1934 which compares with $377,162 in 1933.

Hudson Motor Car Co.

Hudson Motor Car Co. reports a net loss of $3,239,201 for 1934, which compares with a net loss of $4,409,929 for 1933.

CALENDAR OF COMING EVENTS

SHOWS

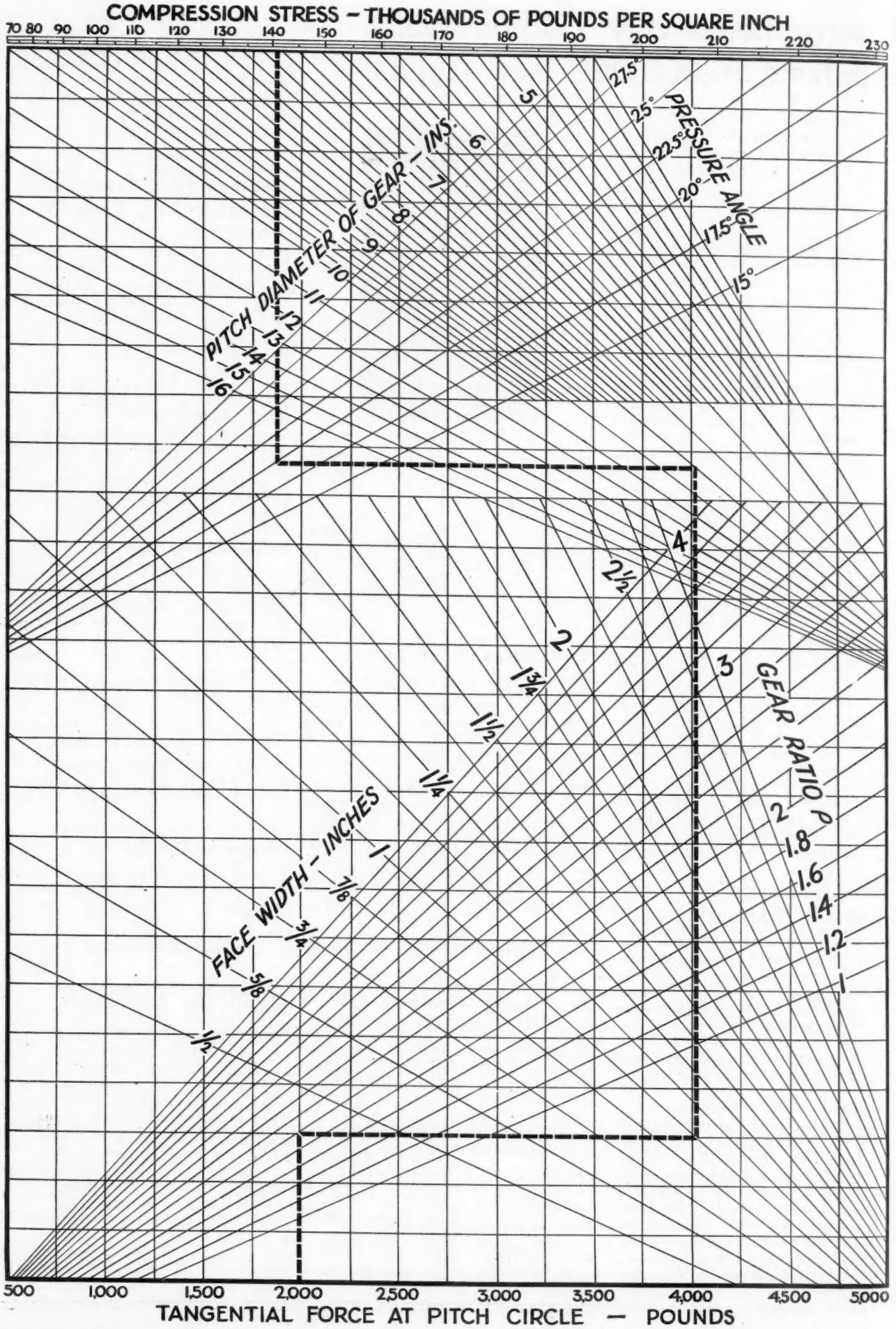
Machine Tool Show—Cleveland..Sept. 11-21
New York Automobile Show, New York, Nov. 2-9
Automotive Service Industries Show—Atlantic City .....Dec. 9-13

CONVENTIONS AND MEETINGS

American Chemical Society, New York, April 22-26
American Welding Society, Annual Meeting—New York City.....April 25
U. S. Chamber of Commerce Annual Meeting, Washington, D. C. Apr. 29-May 2
American Society of Mechanical Engineers (National Oil and Gas Power Meeting), Tulsa, Okla..May 8-11
National Battery Manufacturers Assoc. Spring Convention, Cleveland, May 22-23
Automotive Engine Rebuilders Assoc.—Indianapolis .....May 27-30
S.A.E. Summer Meeting—White Sulphur Springs, Va. .....June 16-20
American Society for Testing Metals, Detroit .....June 24-28
National Assoc. Sales Finance Cos.—White Sulphur Springs.....Sept. 26-28
American Society for Metals, Annual Meeting—Chicago .....Sept. 30-Oct. 4
National Safety Council, Louisville, Ky. .....October 14-18
American Gas Association — Atlantic City .....Oct. 14-18
American Petroleum Institute — Los Angeles .....Nov. 11-14
National Industrial Traffic League—Chicago .....Nov. 20-21

RACES

Race—Indianapolis Race, Indianapolis, May 30


COMPRESSION STRESS – THOUSANDS OF POUNDS PER SQUARE INCH
70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
PITCH DIAMETER OF GEAR – INS.
5 6 7 8 9 10 11 12 13 14 15 16
PRESSURE ANGLE
27.5° 25° 22.5° 20° 17.5° 15°
GEAR RATIO P
4 2½ 2 1¾ 1½ 1¼ 3 2 1.8 1.6 1.4 1.2 1
FACE WIDTH – INCHES
1 ⅞ ¾ 5/16 ½
500 1,000 1,500 2,000 2,500 3,000 3,500 4,000 4,500 5,000
TANGENTIAL FORCE AT PITCH CIRCLE — POUNDS

Gear Tooth Compression-Stress Chart

by P. M. Heldt

Engineering Editor, Automotive Industries

WITH the increase in horsepower of all kinds of automotive equipment, the stresses on the gears through which the power is transmitted to the driving wheels have greatly increased. It was formerly customary to calculate gears for resistance to breakage of teeth only, for which purpose the Lewis formula or a modification of same was generally employed. However, forms of teeth and the materials from which gears are made have been so improved that failure due to tooth breakage is almost a thing of the past. Today gears which carry exceptionally heavy loads usually fail by pitting of the tooth surfaces, which usually occurs first at and near the pitch line.

The compressive stress on the material of the tooth surface under load is given by the equation

$$S_c = \sqrt{\frac{P\,E\,(1+\rho)}{1.75\,D\,f\,\sin 2\,\theta}} \text{ lb. per sq. in.,}$$

where P is the tangential force at the pitch circle, in lb.

E, the modulus of elasticity of the gear material (30,000,000 lb. per sq. in. for steel)
ρ, the ratio between the numbers of teeth in gear and pinion
D, the pitch diameter of the gear, in in.
f, the face width, in in.
θ, the pressure angle.

The chart on the opposite page permits of determining the value of the compressive stress in accordance with this formula by graphical means. The bottom scale represents the tangential force on the pitch circle of the gear, which can be found from the equation $P = 126{,}000\ (Hp./D\ N)$, where D is the pitch diameter of the gear and N is the speed of the gear in revolutions per minute.

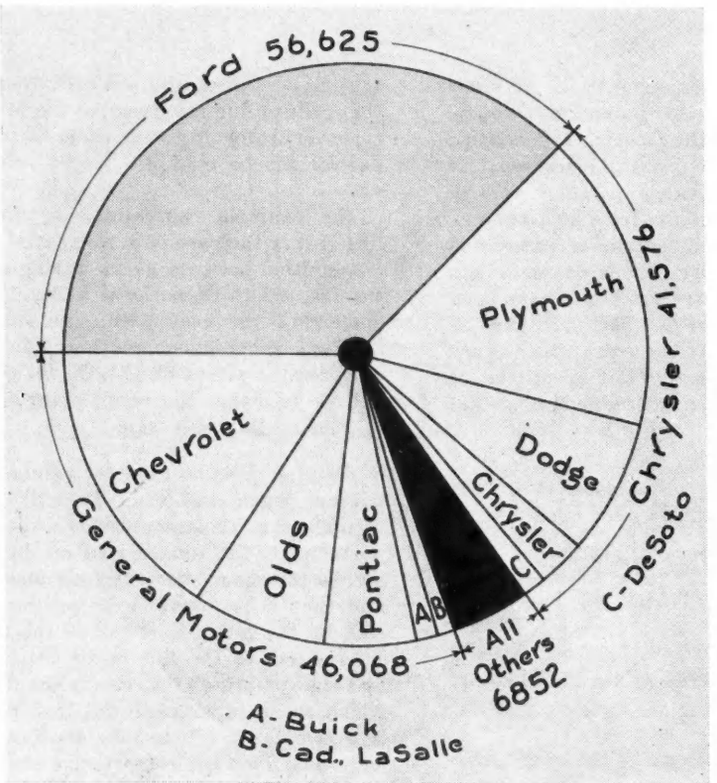
The chart is used as indicated by the heavy line, the pitch line load being located on the bottom scale, from which point one passes up vertically to the inclined line representing the gear ratio ρ, then horizontally to the inclined line representing the face width f, then vertically to the inclined line representing the pitch diameter D, then horizontally to the inclined line representing the pressure angle, and then vertically up to the scale at the top, where the answer can be read off.

The example represented by the heavy dashed line covers the case of a tangential force of 2000 lb. transmitted between gears having a ratio of 2 to 1, the face width of the gear being 1 in., the pitch diameter of the gear 8 in. and the pressure angle 20 deg. Worked out on the slide rule this gives a compression stress of 141,000 lb. per sq. in., and it will be seen that the result obtained from the chart is substantially the same.

The chart can be used for values beyond its range without much difficulty. It will be seen from the formula that the compression stress is directly proportional to the square root of the tangential force and to the square root of (one plus the gear ratio), and that it is inversely proportional to the square root of the pitch diameter of the wheel and to the square root of the face width. Let it be desired to find the compressive stress in the teeth of a gear on which there is a tangential load of 10,000 lb. All that is necessary is to take one-fourth of this (2500 lb.), determine the compressive stress for this force from the diagram and then multiply by 2, which gives the stress for a tangential force of 10,000 lb. The gear ratio can be handled in the same way. For instance, if the actual ratio should be 9 to 1, which is beyond the range of the chart, $1 + \rho = 10$, and one-fourth of this value, 2.5, is taken when using the chart. When the compressive stress for this gear ratio is found by means of the chart, it is multiplied by 2 to get the compressive stress for the actual pair of gears with a ratio of 9 to 1.

If the gear diameter or the face width is outside the range covered by the chart, the best plan usually is to reduce one of the factors in the numerator and one in the denominator in the same proportion. For instance, if it is desired to find the compression stress on the teeth of a gear carrying a tooth load of 12,000 lb. and having a face width of 4 in., the answer can be found from the chart directly by working with a tooth load of 3000 lb. and a face width of 1 in., provided the answer is not beyond the scale of compressive stress.

Three Low-Price Leaders Get 70% of Car Sales Gains in First Two Months



How the numerical increase in new car registrations in the first two months of this year as compared with the corresponding period in 1934, was divided

REGISTRATIONS of new passenger cars were 151,121 larger in the first two months of this year than in the same months last year. This gain represented a 97 per cent improvement for the industry as a whole but due to the manner in which the increase was divided among the various lines, the distribution of the benefits of the expansion was decidedly spotty.

The three leading lines—Chevrolet, Ford and Plymouth—got 70.1 per cent of the increase, or 106,032 units, demonstrating that the trend to the lowest priced cars is continuing. As a result of these gains and substantial increases enjoyed by other divisions of General Motors and Chrysler, the three largest manufacturers show an improvement of 144,269 units over last year. This is 95.5 per cent of the total increase in the first two months and leaves an increase of 6,852 units to be divided among the independent manufacturers.

The largest numerical gain was registered by Ford with an increase of 56,625 units. Plymouth was second with an improvement of 25,396, while Chevrolet, which was bending every effort to step up production during the period, was third with an increase of 24,011 cars. The fourth largest numerical gain in the first two months was registered by Oldsmobile with an increase of 11,367, Dodge was fifth with 10,380 and Pontiac was sixth with 8032. Then in order come Chrysler with 3865, Terraplane with 3677, the largest gain registered by an independent, Buick, DeSoto, Hudson, LaFayette, LaSalle, Hupmobile, Graham, Studebaker, Auburn, Packard, Cadillac and Willys. The remaining lines showed numerical losses.

In the truck field, the total numerical increase in the first two months of this year over the corresponding period last year was 22,177. Of this total, the Ford increase accounted for 14,481. The next largest numerical increase was shown by Dodge with 3108. IHC had the third largest gain amounting to 2253, Chevrolet was next with a numerical improvement of 1933, while GMC was fifth with 420. Although many of the remaining manufacturers showed increases, as a group, they registered 18 fewer trucks in the first two months than they did in the same period last year.

The detail figures, which are the basis of these comparisons, were published in *Automotive Industries* of April 13.

JUST AMONG OURSELVES

Ignition Quality of Diesel Fuels

A CLASSIFICATION for Diesel fuels tentatively proposed by the American Society for Testing Materials comprises one class of fuels intended for use in high-speed engines. Limits are specified for most of the important physical and chemical properties, but there is no limit on the most important property of all, the ignition quality. The reason for this omission, of course, is that a scale for ignition quality and a procedure for determining it have not yet been agreed upon.

It seems to be the intention later on to specify a definite minimum "ignition quality" for fuel for high-speed Diesels, and we have heard 30 cetene number mentioned in this connection. The question then arises as to whether such a limitation is really desirable. Setting a limiting value on the ignition quality of any particular class of fuel is an entirely different matter from standardizing a test for ignition quality and a scale in terms of which it can be expressed.

If a lower limit were to be set on the ignition quality of fuel for any particular class of service, it would have to be set so low that any fuel which could be used with tolerable satisfaction in any engine of the class considered would meet the specification. Now, the tendency to rough operation is dependent not only on the fuel characteristics but also on design features, and it is to be expected that there would be a wide difference between the poorest fuels that "would get by" in some engines and the best the market afforded. Since the producers of the former could claim that their fuel met all requirements of officially sponsored specifications, would not this tend to eliminate the incentive to fuel improvement?

We have never had a limit on the anti-detonating quality of gasoline, but the introduction of the method of expressing anti-detonating value in terms of octane numbers had the effect of stimulating competition between petroleum companies with respect to this quality and proved the origin of a very wholesome industrial development. A similar development with respect to Diesel fuels might be expected if classification according to ignition quality were avoided.

* * *

Differential Discounts

WITH open territory contracts, particularly in large cities where a number of dealers represent a single line of cars, many dealers feel that there is no real incentive for them to seek to develop sales. They contend that if they uncover and develop a prospect as the result of special sales activity, more than likely some other dealer who has none of the expense of the developmental work will make the sale by offering a higher allowance on the used car.

A good dealer friend of ours thinks that this situation could be remedied by the adoption of differential discounts. Each dealer would be allotted a territory to which he would not have exclusive rights. However, on all sales he made in the territory allotted to him, he would get three or four per cent more discount than on sales he made outside of that territory. This would give each dealer an incentive for working his own territory more intensively, would give him something to cover any added sales costs and, at the same time, the margin would not be big enough to allow him to rest on his oars as, if he did, neighboring dealers would still be able to take business from under his nose.

There would be arguments, of course, over where individual buyers lived with conflicting claims of dealers to be ironed out. But they probably wouldn't be as serious as is the case where an attempt is made to enforce closed territories.

At any rate, the idea seemed interesting enough to us to warrant its presentation here.

* * *

Drives for Rear Engined Buses

SOME rather interesting work is being done in working out the drives for buses with rear-mounted engines. As is probably pretty generally known, the new Yellows on the Madison Avenue line in New York City have their engines mounted parallel and in back of the rear axle, the drive being through a sharply angled propeller-shaft connecting the two. The transmission is pneumatically operated. At least one other maker is working on a design that would have the engine set transversely directly above the rear axle, the drive in this case being through a vertical shaft with a splined slip joint. When and if the passenger car engineers get around to putting engines in the back, experience gained in this work may prove decidedly helpful.

The Editors

Unit-Type Machines Promise N Economies in the Industry's P

by Joseph Geschelin
Engineering Editor, Automotive Industries

BECAUSE of the great concentration of automotive plants within a rather well-defined mid-western area, many people are prone to assume that all automotive activity is centered there and that the total of all manufacturing establishments consists of a relatively small number of large units.

Both conclusions are wide of the mark. If we consider the automotive industry as comprising all companies engaged in the manufacture of the various component parts of motor vehicles, we envision a great group of plants permeating the many widely separated industrial sections of the country. While it has been known that the number of such establishments is large, only a few people seem to know approximately how many units there are.

Let it be understood that the number of units depends to a large extent upon the type of plant and type of activity. This will be evident from the analysis of one phase of this question in the article, "Does the Parts Industry Need Its Own Labor Board?" by Athel Denham, in *Automotive Industries*, Sept. 29, 1934. In the present discussion we are concerned with all manner of parts producers catering not only to manufacturers but to the after market, encompassing a grander total than is ordinarily appreciated and extending country-wide.

Gigantic Industry Supplies Automotive Needs

On the assumption that an estimate of the field might be of general interest, *Automotive Industries* conducted a survey recently by analyzing the active files of the Chilton Company's directory department. By actual count it was found that there are 3087 establishments producing fabricated parts, chiefly metallic, and comprising such items as engines and engine parts, clutches and parts, transmissions and parts, front and rear axles and parts, steering gear and parts, ignition, carburetors, electrical units; chassis units such as springs, frames, bumpers, brakes and parts, etc.

This group includes, naturally, not only subsidiary companies of the car manufacturers but independent parts suppliers, as well as the producers of replacement parts of every description, often built for the service trade only.

Add to this a group of some 677 manufacturers of non-metallic parts such as molded products of Bakelite, rubber, tires, mica, fiber, etc., and you have the picture of a gigantic industrial system converting raw materials of every description into the finished products required by the motor vehicle manufacturers and the service industries.

It is of interest to consider the production problems of this parts industry. One approach is found in the 1934 Production Issue of *Automotive Industries*, wherein we presented a sample of the activity in certain of the larger plants in the Detroit area. And the first conclusion that one may reach on the basis of the evidence is that the production problems of these companies are entirely different from those of the large automobile manufacturer.

Generally, the parts industry is subject to the following qualifications so far as its economic status is concerned:

1. Seasonal production.
2. Small lot or at least variable lot production.
3. Need for great flexibility of production equipment and tooling.
4. Need for equipment which may be quickly changed from one job to another.
5. Low overhead.

Consider now that the very existence of the parts maker depends upon his ability to produce certain parts at a cost that beats the cost of his customer as well as that of his competitor. That's why the questions of production equipment are so important; that's why these companies, or at least the progressive elements, must utilize the best that the art affords in the way of cost-reducing equipment.

The production equipment problem of the parts makers, of necessity, has been colored by the economic forces mentioned above. The demand for flexibility, for frequent set-up due to lot production, for inexpensive tooling due to the probability of design changes, all have been met by the installation of more or less general purpose machines—not the most economical so far as comparative unit cost is concerned, but certainly the most economical in the light of the overall considerations.

New Equipment to Meet Rising Costs

What with the rising cost of raw materials and labor on the one hand and the constant pounding for lower cost on the other, the factory executive has a difficult job on his hands. Can he make the grade with the old equipment? What kind of new equipment will best suit his conditions?

It is quite time to admit that much of the old equipment will not do, what with the progress of competitors within the parts industry as well as the probable action of present customers who are the potential competition. Great strides have been made in the design of

New Production Parts Plants

new machinery during the past five years or so. Not the least of the improvements are: higher speeds—making possible the fullest advantages of better cutting tools; increased rigidity and other details making for better accuracy, thus answering the demand for better quality without increasing inspection cost; more flexibility and simpler controls—reducing the need for machine tenders and permitting individual operators to handle batteries of machines.

Single-purpose machines, of course, are being used and will continue to be used wherever they are justified by the permanency of the product or great quantity or the combination of many factors.

However, the brightest prospects in parts production lie in extending the application of the so-called unit-type machine which is in effect a single-purpose machine for any given set-up, but so flexible in construction that it can be changed over for the production of an entirely different job without much capital outlay. While such machines have been available for a number of years, their application has been confined largely to more or less single-purpose jobs where there was a prospect of rather frequent style changes. And we submit that the unit-type machine should be given serious consideration by the alert group of parts factory executives who are looking for the solution of the grave questions facing them this coming year.

There is little doubt that the improvement of production facilities in many parts plants has been discouraged by lack of funds. And that's another point where the unit machine can score. Given the right set-up based on a careful selection of equipment, the investment in unit machines need not be, in fact should not be, amortized over any brief period or over any given product. Indeed, the only portion of the investment that need be carried by current production is the portion that can't be salvaged for another part—usually less than 25 per cent of the investment.

The rest of it can be amortized over a much longer period, probably on the same basis as for the general-purpose machine.

For the present we are unable to point to many specific examples of the application of unit-type equipment in parts plants. However, there are many successful installations in other types of manufacture within the automotive industry, the most recent being the production line developed for building the White Pancake engine.

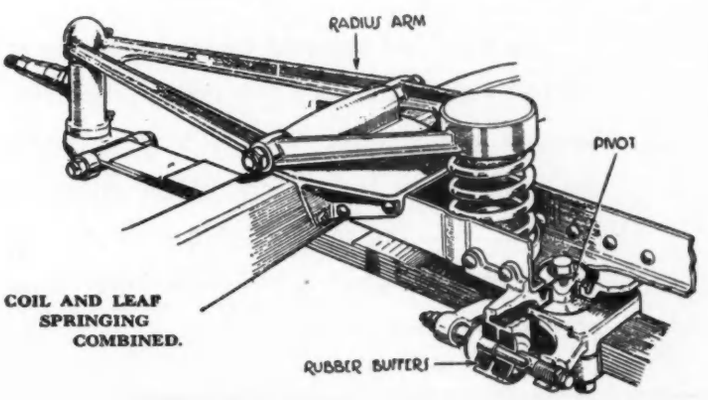
To those production men who are on the lookout for the best way of meeting the demand for a better product at a competitive cost we recommend a careful study of unit-type equipment. The first step is to survey the present facilities with an open mind, admitting that what you have is by no means the last word. When you are in a receptive mood, we are confident that the engineering experience of the leading machine tool experts can be directed so as to reach the most economical solution.

New Independent Suspension Cushioned Against Horizontal Shocks

A BRITISH patent has been taken out by the Daimler-Benz Company on an improvement on front independent springing whereby the front wheels are cushioned slightly against horizontal shocks in the direction of motion.

As will be seen from the illustration, the steering heads are supported by a transverse spring and by two radius arms. The box, or clamp, at the centre of the spring is mounted on a vertical pivot, on which it can swing to a slight extent. To limit the movement, arms project from the clamp and are connected by an adjustable screwed spindle which carries washers acting against rubber buffers contained in a ring fitted to the chassis frame. Consequently, when a horizontal blow is applied to one of the wheels in line with the direction in which it is rolling, the spring swings to a slight extent, thus compressing one of the rubber buffers. The buffers are, therefore, able to keep the movement within reasonable limits.

In order to permit of this action the upper connection between each steering head and its radius arm takes the form of a ball joint. At the lower end a plain eye is used to join the steering head to the end of the transverse spring, any slight twisting effect being taken up by the spring itself. Auxiliary coil springs are employed between the inner ends of the radius arms and a cross-member of the frame.—*The Motor*, Dec.



COIL AND LEAF SPRINGING COMBINED.

The Analytical the Flexibility

THE problem of proper car springing occupies the automobile engineer more today than it has ever occupied him before. Introduction of independent springing has rendered the motoring public, as well as the car builder, more sensitive to riding qualities. After a thorough analysis of the car with respect to weight, wheelbase, center of gravity, radius of gyration, sway center and suspension features, the ride problem resolves itself into determining the optimum flexibility of the car springs in conformity with the factors listed. These car springs are, in most cases, either coil springs or leaf springs of a simple "straight-line" type. No difficulty is experienced in calculating accurately the flexibility of a coil spring as expressed by its spring rate. The situation is not quite so simple in the case of leaf springs, however.

The plain fact is that after a century of extensive use of leaf springs for railroad and automobile purposes, they are still calculated as if they were beams of uniform strength, regardless of the arrangement and gage of the individual leaves. While most authors state explicitly that this treatment is faulty, evidently no attempt—or at least no successful attempt—has been made to analyze an actual leaf spring, which, as a rule, is far from being a beam of uniform strength. In this connection one frequently meets with statements to the effect that "the precise equations are quite involved and very lengthy."

While in the past the use of a rule of thumb in connection with leaf springs may have been tolerable, the precision required when modern motor cars are to be given the very best riding properties, makes it necessary to predetermine the flexibility of leaf springs by an exact scientific method; only thus can we hope to select that particular arrangement of leaves that suits our purpose best.

It is the object of this article to furnish a true solution of the leaf-spring problem. In presenting it the writer wishes to acknowledge his indebtedness to the management of the Chevrolet Motor Co. for its traditional interest in engineering problems of a scientific character.

The method of calculating the rates of leaf springs which is offered in the following pages is not only precise, but also simple. The equations used are as short as the "uniform-strength" formulæ, and by their means any spring problem can be solved quickly. The spring rates calculated by this method check with the results obtained with an Olsen spring-testing machine when concentrated loads are applied at the spring seat and the spring eyes.

Owing to the newness of the approach to the spring problem, represented by the method here given, it was considered necessary to explain matters at some length. The reader will find, however, that the results of the method which are used by the engineer are concise and practical. In order to bring out these results and the manner of procedure more succinctly, the following analysis is divided into a Practical Section and a Theoretical Section. Each of these sections may be studied alone, although each supplements the other.

"The precision required when modern motor cars are to be given the very best riding properties," Mr. Samuels says, "makes it necessary to predetermine the flexibility of leaf springs by an exact scientific method. . . . The method of calculating the rates of leaf springs" which is presented here "is not only precise, but also simple."

Practical Section

Spring Rate of a Symmetrical Spring

Fig. 1 represents one-half of a conventional leaf spring. We will consider the latter to be symmetrical, so that the missing half is an exact image of the half shown. Reference lines are the spring center line X-X and the axis Z-Z of the spring eye, which is parallel to X-X. It will be seen that the spring half is divided into as many steps as there are leaves, step No. 1 being adjacent to the spring eye, and the last step (here No. 7), adjacent to the center line X-X. The leaves themselves are numbered consecutively from the main plate down, the main plate being No. 1. The number of steps, however, does not need to coincide with the number of leaves, as there may be two leaves of the same length.

In making the calculations, we consider, not the individual leaves but the individual steps, and for each step we establish two determinants, viz., the arm length T and the "yield value" V.

The arm length T of a step is merely the distance of its inner end (the end nearest to X-X) from line Z-Z. So if step No. 4 extends from the end of leaf No. 4 to the end of leaf No. 5, and A_5 is the length of leaf No. 5, as shown in the drawing, then T_4, the arm length of step No. 4, is equal to A_1—A_5, where A_1 is the length of leaf No. 1. It will be noted that the last step (here No. 7) extends from the end of the last leaf to the center line X-X. Hence the arm length T_L of the last step (here T_7) is equal to A_1. The lengths of the various steps do not enter into the calculation. If, as is frequently the case with passenger-car springs, the ends of supporting leaves are bent down, these bent-down portions are ineffective and are not included in the leaf length A. Thus in the general equation

$$T_n = A_1 - A_{(n+1)} \quad . \quad . \quad . \quad . \quad (1)$$

$A_{(n+1)}$ represents the effective length of leaf No. $(n + 1)$.

The second determinant of each step is its yield value V. To establish V for a given step, we mentally cut the spring close to the two ends of that step. Lines m-m and n-n in Fig. 1 represent the sections or cutting planes

Determination of of Leaf Springs

by William Samuels*

for step No. 4. It will be seen that lines *m-m* and *n-n* are slightly to the right of the two ends of the step, so that *m-m* cuts the leaves of step No. 4 and *n-n* the leaves of step No. 5.

For section *m-m* we determine the moment of inertia of each leaf cut, around its own neutral axis. Since line *m-m* cuts four leaves, there will be four moments of inertia, M_1, M_2, M_3, and M_4, each determined by an equation of the form

$$M = 1/12\, BH^3 \quad . \quad . \quad . \quad . \quad (2)$$

where B is the width and H the thickness of the leaf in question. The total moment of inertia I_4 of step No. 4 at section *m-m* is then given by the equation

$$I_4 = M_1 + M_2 + M_3 + M_4 \quad . \quad . \quad (3)$$

The deflection or yield of a beam under load is inversely proportional to the moment of inertia of its section. Hence we will call the reciprocal of I_4 the "yield factor" of step No. 4 and designate it by Y_4. This gives

$$Y_4 = \frac{1}{I_4} \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

In the same way we get for the moment of inertia of step No. 5 at section *n-n* the expression

$$I_5 = M_1 + M_2 + M_3 + M_4 + M_5 = I_4 + M_5 \quad . \quad (5)$$

and for the yield factor of step No. 5 on line *n-n* the equation

$$Y_5 = \frac{1}{I_5} \quad . \quad . \quad . \quad . \quad . \quad . \quad (6)$$

Now, the yield value V_4 of step No. 4, which is the magnitude we need for our calculation, is given by the equation

$$V_4 = Y_4 - Y_5 \quad . \quad . \quad . \quad . \quad (7)$$

Thus the yield value of a step may be defined as the difference between the yield factor of that step and the yield factor of the next higher step or as the difference between the yield factors of the step border sections. The border sections of a step are so located that, approaching from the spring eye, at each end of the step we first come to the end section, then to the border section.

If we apply this rule to the last step, that is, step No. 7 in Fig. 1, we see that the second border line falls outside of the figure. As explained in the Theoretical Section, for the purpose of this analysis, each spring half is considered to be a cantilever fixed at the spring center line *X-X*. Consequently, the second borderline of the last step (here No. 7) cuts through the encastré section of a cantilever, a section whose yield factor equals zero. Hence we write

$$V_7 = Y_7 - 0 = Y_7$$

and, in general if $_L$ signifies the last step,

$$V_L = Y_L \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (8)$$

Having established for each step its determinants V and T, we calculate the corresponding value of the expression VT^3. We add the various terms VT^3 together and designate this sum by ΣVT^3. The theoretical spring rate of the symmetrical spring is then given by the equation

$$R = \frac{6E}{\Sigma VT_4^3} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (9)$$

Here E represents the modulus of elasticity of the spring material. For steel E is equal to 30,000,000 lb. per sq. in., and we may therefore write

$$\mathrm{R} = \frac{180{,}000{,}000}{\Sigma VT^3} \text{ lb. per in.} \quad . \quad . \quad (10)$$

Equations (9) and (10) are based on an assumption which is universally made in spring calculations, namely, that the deflection of a leaf spring is equal to the deflection of an integral plate formed by placing the individual leaves side by side instead of stacking them. As a matter of fact, a stacked or laminated spring, owing to the splitting of leaves, is somewhat weaker than the equivalent integral plate. There is, however, a constant ratio between the true or laminal-spring rate R' and the theoretical spring rate R obtained from equation (9) or (10). This ratio, as found from comparisons of calculated values R with spring rates determined by test, is 0.838. Hence our equation for the laminal-spring rate R' is

$$R' = 0.838\ R \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (11)$$

In Fig. 2 the arithmetical set-up for computing the spring rate of a symmetrical leaf spring is given in the form of a sample calculation. The calculation is simple and not unduly long. If forms similar to the one on which the example is worked out are available, it will prove a help in working out the problem.

Spring Rate of an Unsymmetrical Spring

The calculation of an unsymmetrical spring is not very different from that of a symmertical spring. Each half of the symmetrical spring is considered in the same manner as one-half of the

*Mr. Samuels is in charge of the analytical engineering work of the Chevrolet Motor Co.—Editor.

FIG. 1

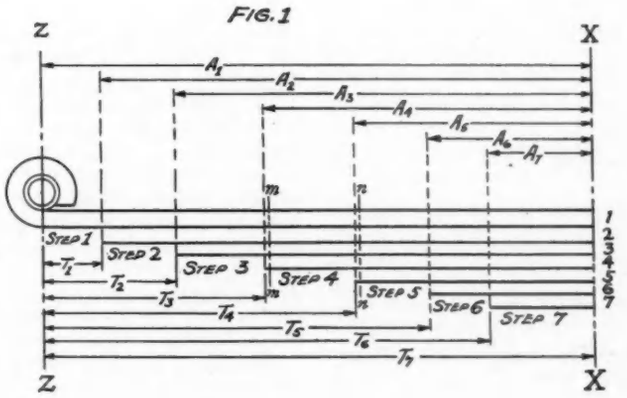


FIG 2

SAMPLE SPRING RATE CALCULATION
(SYMMETRICAL SPRING)

SPRING WIDTH B	LEAVES	GAGE	THICKNESS H	MOMENT OF INERTIA $M=\frac{1}{12}BH^3$
1.75 IN	No.1 to No.	No. 4	0.238 IN	$\frac{1}{12}(1.75)(0.238)^3 = .001967$ IN.^{4}
	No.2 to No. 7	No. 5	0.220 IN	$\frac{1}{12}(1.75)(0.220)^3 = .001553$ IN.^{4}
	No. to No.			

	LEAF LENGTH A (IN.)		MOMENT ARM T=A₁-A (IN.)		MOM. O' INERT. OF STEP I (IN⁴)		YIELD FACTOR OF STEP Y=I/I (1/IN)⁴		YIELD VALUE OF STEP V (1/IN)⁴ V₁=Y₁-Y₂ V₂=Y₂-Y₃ ETC.		T³ (IN.³)	VT³ (1/IN.)
A_1	16.5											
A_2	15.375	T_1	1.125	I_1	0.001967	Y_1	5084	V_1	224.3	T_1^3	1.424	320
A_3	13.062	T_2	3.438	I_2	0.003520	Y_2	2841	V_2	87.0	T_2^3	40.6	3530
A_4	10.687	T_3	5.813	I_3	0.005073	Y_3	1971	V_3	46.2	T_3^3	196 4	9070
A_5	8.375	T_4	8.125	I_4	0.006626	Y_4	1509	V_4	28.7	T_4^3	536 4	15400
A_6	6.062	T_5	10.438	I_5	0.008179	Y_5	1222	V_5	19 5	T_5^3	1137	22170
A_7	3.687	T_6	12.813	I_6	0.009732	Y_6	102.75	V_6	14.1	T_6^3	2103	29660
A_8	0.000	T_7	16.5	I_7	0.011285	Y_7	88.6	V_7	88.6	T_7^3	4492	398000
A_9		T_8		I_8		Y_8		V_8		T_8^3		
A_{10}		T_9		I_9		Y_9		V_9		T_9^3		

$\Sigma VT^3 = 478\,150\ 1/\text{IN.}$

THEORETICAL SPRING RATE $R = \frac{6E}{\Sigma VT^3} = \frac{180000000}{478\,150} = 376.5$ LBS/IN.

LAMINAL SPRING RATE $R = .838\,R = .838\,(376.5) = 315.5$ LBS/IN.

symmetrical spring. The same symbols are used as in the previous case—capital letters for one half of the spring and corresponding small letters for the other half, which leads to the two summations ΣVT^3 and Σvt^3.

In Fig. 3 we have a spring whose main plate has a length A_1 to the left of the point of support (between lines X-X and Z-Z) and a length of a_1 to the right of the point of support (between X-X and z-z). The distance between spring-eye centers is C. Hence $C = A_1 + a_1$. The proportional lengths of the two sections of the spring then are

$$K = \frac{A_1}{C} \quad \ldots\ldots (12)$$

and

$$k = \frac{a_1}{C} \quad \ldots\ldots (13)$$

The summation ΣVT^3 and proportion K go with length A_1, while summation Σvt^3 and proportion k go with length a_1. These definitions lead to the theoretical spring rate R_u of an unsymmetrical spring,

$$R_u = \frac{3E}{k^2\Sigma VT^3 + K^2\Sigma vt^3} \quad \ldots (14)$$

Attention is called to the fact that in equation (14) the proportional length of the short arm goes with the summation for the long arm, and vice versa. It will be observed also that, for $k = K = \frac{1}{2}$ and $\Sigma VT^3 = \Sigma vt^3$, equation (14) is reduced to equation (9). Equation (14) may also be written in the form

$$R_u = \frac{90{,}000{,}000}{k^2\Sigma VT^3 + K^2\Sigma vt^3} \quad \ldots (15)$$

Using the same reasoning as before, we find for the laminal-spring rate of an unsymmetrical spring the equation

$$R'_u = 0.838\,R_u \quad \ldots\ldots (16)$$

To avoid uncertainties, it may be added that the spring rate of an unsymmetrical spring is measured along the spring center line (line X-X in Fig. 3).

Leaf-Spring Stresses

From the spring rate we can easily calculate the stresses of the various leaves due to a given spring deflection. We will for the moment ignore the weakening of the spring in the center plane X-X (the most highly stressed section) due to the center-bolt hole. All stress equations given here pertain to this cross-section. The same designations are used as in the rate calculation. In addition, the spring deflection is designated by f, the thicknesses of successive leaves are H_1, H_2, H_3, etc. (H_1 pertaining to the main plate) and the total moment of inertia in the center plane is I_L (in accordance with the designations of equation 8). I_L is calculated without considering the spring-bolt hole, hence is identical with the last item in the "I" column of the computing sheet (see sample calculation). The stresses in successive leaves are designated by S_1, S_2, S_3, etc. (corresponding to H_1, H_2, H_3, etc.).

We first derive equations for the stress in the main plate (No. 1) for both the symmetrical and the unsymmetrical spring. From the values obtained from these equations, those for the stresses in the remaining leaves are found by simple proportion.

For the main plate of a symmetrical spring

$$S_1 = \frac{R'fA_1H_1}{4I_L} \quad \ldots\ldots (17)$$

For the main plate of an unsymmetrical spring

$$S_1 = \frac{R'_u fCH_1}{2I_L}Kk \quad \ldots\ldots (18)$$

It will be noticed that with $K = k = \frac{1}{2}$ and $A_1 = \frac{1}{2}C$, equation (18) is reduced to equation (17). Having determined S_1, we obtain the stresses in the remaining leaves of an unsymmetrical as well as of a symmetrical spring from the equations

$$S_2 = S_1\frac{H_2}{H_1} \quad S_3 = S_1\frac{H_3}{H_1}$$

$$S_4 = S_1\frac{H_4}{H_1} \text{ etc.} \quad \ldots\ldots (19)$$

The center section of a spring is usually weakened by a bolt hole. In that case, if B is the spring width and D the diameter of the hole, the stress values of equations (17) to (19) are increased in the ratio

$$u = \frac{B}{B-D} \quad \ldots\ldots (20)$$

Hence, designating the increased leaf stresses by S'_1, S'_2, S'_3, etc., we may write

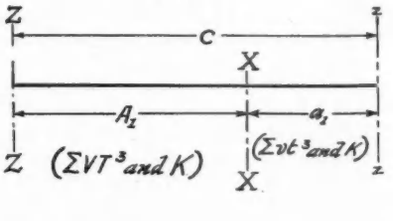
$$S'_1 = uS_1 \quad S'_2 = uS_2 \quad S'_3 = uS_3 \text{ etc.} \quad \ldots\ldots (21)$$

Theoretical Section

Rate of a Symmetrical Spring

Fig. 4 is a spring diagram relating to a symmetrical spring, in which an equivalent integral plate has been substituted for the stacked leaves. The rectangle $a_1\ b_1\ c_1\ d_1$ represents the main plate, $a_2\ b_2\ c_2\ d_2$ represents the second leaf; $a_3\ b_3\ c_3\ d_3$, the third leaf, and so on. For greater clarity of the diagram, the rectangles are only partly drawn, but they are easily recognized. Let the thickness of the integral plate be equal to the thickness H_1 of the main plate. Then $\overline{a_1c_1}$ equals the width B of the main plate. For the general case of a spring with supporting plates having thicknesses different from that of the main plate, the width of any of the remaining rectangles making up the

FIG. 3



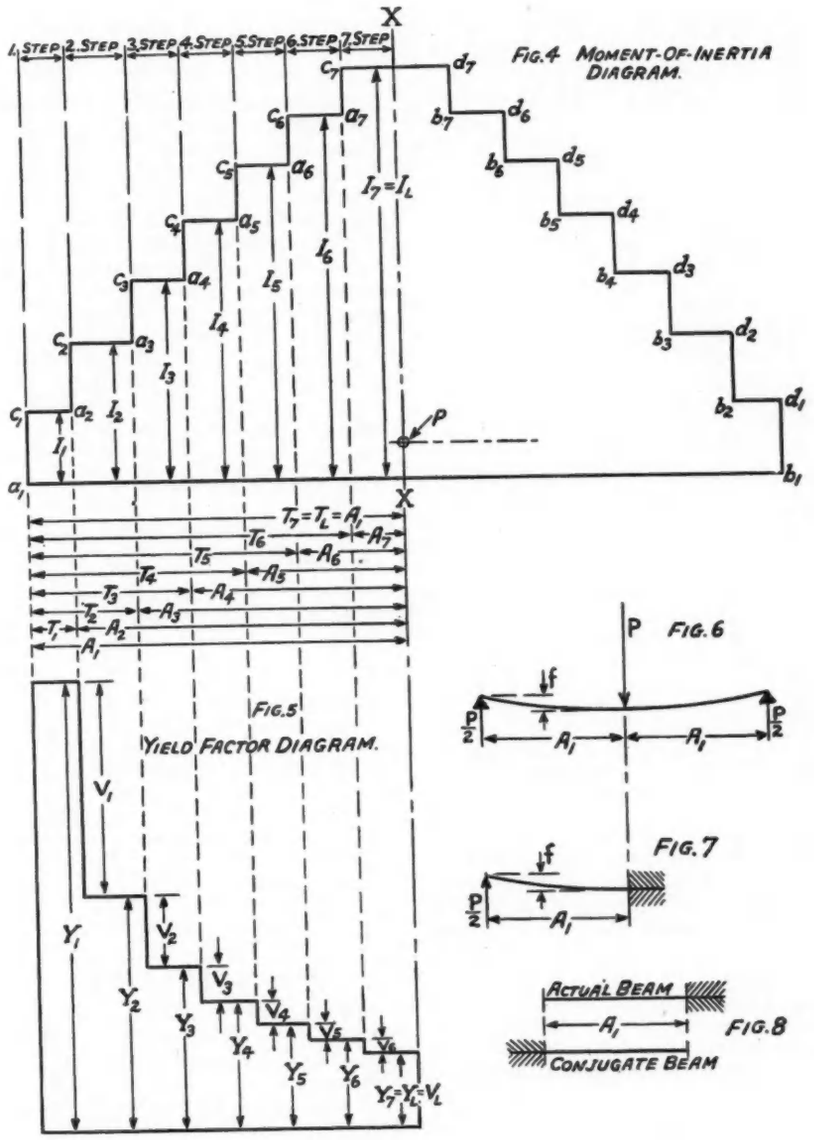


FIG. 4 MOMENT-OF-INERTIA DIAGRAM.

FIG. 5 YIELD FACTOR DIAGRAM.

FIG. 6

FIG. 7

FIG. 8

integral plate will not be the width of the plate represented by the rectangle. Instead, each rectangle will have such a width that, considering the plate thickness H_1, the moment of inertia of the rectangle will be equal to that of the corresponding plate. In an actual leaf spring all leaves are made of the same width B for practical reasons. Then, if the actual thickness of the second leaf is H_2, the diagram width $\overline{a_2c_2}$ $(=B'_2)$ of the second rectangle $(a_2b_2c_2d_2)$ will be given by the equation

$$B'_2 = B\left(\frac{H_2}{H_1}\right)^3 \quad . \quad . \quad . \quad . \quad . \quad (I)$$

Similarly, we have for the diagram width $\overline{a_3c_3}$ $(=B'_3)$

$$B'_3 = B\left(\frac{H_3}{H_1}\right)^3,$$

and so on.

If we now apply a load P at the center line X-X of the integral plate and on the longitudinal center line of the rectangle $a_1b_1c_1d_1$ while the plate is supported on lines a_1c_1 and b_1d_1, then the theoretical deflection of the plate will be identical with that of the equivalent leaf spring loaded correspondingly. The fact that the integral plate of Fig. 4 is unsymmetrical with respect to the longitudinal axis of rectangle $a_1b_1c_1d_1$ does not matter, for we could replace the diagram plate again by another equivalent plate arranged symmetrically about the same longitudinal axis. This, however, would not change the result, hence is unnecessary.

We see now that the integral plate of Fig. 4 represents a beam, supported at the ends and loaded at the center by the single force P. The cross-sections of the beam change abruptly, as shown in Fig. 4. These steps are identical with the steps of the equivalent leaf spring. For calculating the deflection of the beam (plate), we need the moment of inertia of each of its steps. The moments of inertia of the successive steps are proportional to the widths of these steps (width meaning the distance from the zig-zag line to line $\overline{a_1b_1}$). Hence the widths of the steps, measured in an appropriate scale, also represent the moments of inertia I_1, I_2, I_3——I_7 of the seven steps on one side of the diagram. In Fig. 4 the widths of the steps on the left half are marked in this manner, while the right half of the figure is left blank, so as to avoid duplication. If for the last step and the last leaf (No. 7 in Fig. 4) we use the index "L," I_7 is identical with I_L. Furthermore, if we designate the moments of inertia of the successive leaves, taken about the neutral axes of these leaves, by M_1, M_2, M_3——M_L, we can express I_4, for instance, as

$$I_4 = M_1 + M_2 + M_3 + M_4$$

In general terms, we write for the moment of inertia of the nth. step

$$I_n = M_1 + M_2 + M_3 + \text{——}M_n \quad . \quad . \quad (II)$$

Hence the moment of inertia I_L of the last step equals the total moment of inertia at the spring center:

$$I_L = M_1 + M_2 + M_3 + \text{——}M_L \quad . \quad (III)$$

For our calculation we need the reciprocals of the I values, for which, in our Practical Section, we introduced the term "yield factor" and the designation Y. We have

$$Y_n = \frac{1}{I_n} \quad . \quad . \quad . \quad . \quad . \quad (IV)$$

Fig. 5 is the yield-factor diagram of a spring whose moment-of-inertia diagram is shown in Fig. 4. Only the left half of the spring is considered in Fig. 5. In this diagram also the successive yield values V are shown graphically. We see that the yield value V_4, for instance, which corresponds to the yield factor Y_4 and to the fourth step, is defined as

$$V_4 = Y_4 - Y_5$$

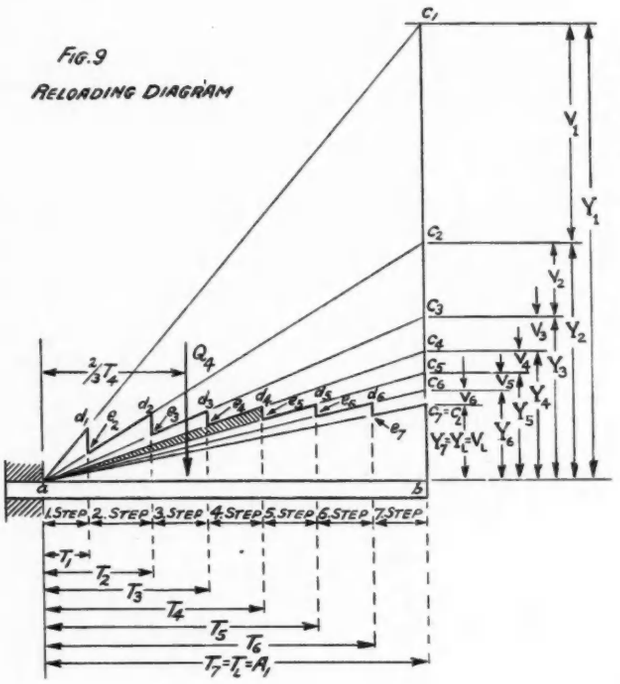
In general we have

$$V_n = Y_n - Y_{(n+1)} \quad . \quad . \quad . \quad . \quad (V)$$

Furthermore, we note that for the last step the yield value is identical with the yield factor

$$V_L = Y_L \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (VI)$$

In connection with the further analysis a few general remarks are in order. If, as shown in Fig. 6, we have a beam which is supported at the ends and subjected to a load P at the center, so that the distance between P and either end is equal to A_1, we can calculate the deflection from the actual situation as represented by Fig. 6, or we can calculate the deflection of each side by replacing the actual beam by a cantilever beam of corresponding section, fixed at the beam center, of length A_1 and subjected to an upward force $P/2$ at the end, as shown in Fig. 7. In both cases



all deflections, including the maximum deflections f, will be identical, and so will the stresses. The "cantilever approach" is preferable in solving spring problems because it leads to much simpler equations.

For determining the maximum spring deflection f, on which the spring rate depends, we use the "conjugate-beam" principle, according to which, if we use the "modified bending-moment diagram" of the actual beam as a load diagram for the "conjugate beam," then the resultant-bending-moment diagram of the latter is also the deflection diagram of the actual beam.

The modified bending moment diagram of a beam is obtained by dividing each ordinate of the bending moment diagram by EI, where E is the modulus of elasticity of the beam and I the moment of inertia of the beam section corresponding to the ordinate.

The conjugate beam is an imaginary beam, introduced as an analytical expedient. It always has the same length as the actual beam. Its support, however, often differs from the support of the actual beam. In the case of a cantilever beam the conjugate beam is also a cantilever; but the free end of the conjugate beam corresponds to the fixed end of the actual beam, and vice versa. This is illustrated in Fig. 8.

Application of the conjugate-beam principle to our spring problem is illustrated by Fig. 9. This diagram is a continuation of the diagrams of Figs. 4 and 5, point a and line $\overline{b\ c_1}$ of Fig. 9 corresponding to point a_1 and line X-X in Fig. 4 respectively. Also, the steps marked in Fig. 9 are identical with those marked in Figs. 4 and 5. It will be noticed, however, that the cantilever $\overline{a\ b}$ of Fig. 9 has its fixed end at a, while the left section of the spring represented in Figs. 4 and 5 should have its fixed end at b. Consequently, in Fig. 9, $\overline{a\ b}$ is not the actual beam but the conjugate beam. Hence, when we determine the modified-bending-moment diagram of the actual beam, we must visualize cantilever $\overline{a\ b}$ as having its free end at a and its fixed end at b. Concerning the positioning of the various steps by the lengths (A_1, A_2 —— A_L) of the successive leaves and by the lever arms (T_1, T_2 —— T_L), the reader is referred to Figs. 4, 5 and 9, and also to the Practical Section. We have for the arm length T_n of the nth. step

$$T_n = A_1 - A_{(n+1)} \quad . \quad . \quad . \quad . \quad . \quad \text{(VII)}$$

If we load (or lift) the free end a of the actual cantilever ab by a force $\frac{P}{2}$, corresponding to a spring-center force P (see Figs. 6 and 7), the bending-moment diagram will be a triangle similar to abc_1 of Fig. 9, the ordinate at b being equal to the bending moment $M = \frac{1}{2} PA_1$. If the beam had a constant section equal to that of the first step of moment of inertia I_1, the modified-bending-moment diagram would be a triangle with an ordinate at b equal to

$$\frac{M}{EI_1} = \frac{PA_1}{2EI_1}$$

For our analysis we will assume a definite value M_e for the maximum bending moment M. We make M_e equal to the modulus of elasticity E. That a spring of ordinary proportions could not withstand such a tremendous bending moment (30,000,000 lb.-in.), does not matter in a theoretical analysis. If we designate the central spring force P that produces M_e by P_e, we can write

$$M_e = 1/2\ P_e A_1 = E \quad . \quad \text{(VIII)}$$

Hence $$P_e = \frac{2E}{A_1} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad \text{(IX)}$$

With the above maximum bending moment M_e, the height $\overline{bc_1}$ of the triangle abc_1, representing the modified-bending-moment diagram for the cantilever of constant moment of inertia I_1, is found to be

$$\overline{bc_1} = \frac{M_e}{EI_1} = \frac{E}{EI_1} = \frac{1}{I_1} = Y_1 \quad . \quad . \quad \text{(X)}$$

Similarly, if we substitute successively cantilevers of constant-yield factors Y_2, Y_3 Y_4 —— Y_L, their modified bending moments will be represented respectively by triangles over the base $\overline{ab}$ of heights

$$\overline{bc_2} = Y_2,\ \overline{bc_3} = Y_3,\ \overline{bc_4} = Y_L.$$

All these triangles are shown in Fig. 9.

We can now construct the modified bending-moment diagram of the left spring half, by considering that the ordinates of ac_1 over step No. 1 belong to that step; the ordinates of ac_2 over step No. 2, to step No. 2, and so on. This is so because the yield factor Y_1 of step No. 1 is represented by bc_1, that of step No. 2, Y_2, by bc_2, etc. It is thus seen that the modified bending-moment diagram of the cantilever representing the left spring half is bordered by the line $\overline{ab}$, the line $\overline{bc_L}$, and the zig-zag line $a\ d_1\ e_2\ d_2\ e_3\ d_3\ e_4\ d_4$ —— $e_7\ c_L$ (Fig. 9).

According to our explanation, the area of this modified bending-moment diagram must be considered as the distributed load of the conjugate cantilever beam $\overline{ab}$ (fixed at a). We could now construct the bending-moment diagram of the conjugate beam due to this distributed load area, which we may call the reloading area. This bending-moment diagram of the conjugate beam would also be the deflection diagram of the actual beam. The maximum ordinate of the bending-moment diagram would be at a, where the actual cantilever (at its free end) has the greatest deflection. Since we are interested only

in this maximum deflection, which is determined by the bending-moment produced by the reloading area at the fixed end a of the conjugate cantilever, we can dispense with the rest of the bending-moment (or deflection) diagram.

We wish to determine, then, the bending-moment produced by the reloading area at the fixed end a of the conjugate cantilever ab. It will be observed that the reloading area is made up of a series of triangles, all having a common apex at a. These triangles are $a\ d_1\ e_2$, $a\ d_2\ e_3$, $a\ d_3\ e_4$ —— $a\ d_6\ e_7$. In addition there is the larger triangle $a\ c_L b$. The bending moment of the total reloading area about point a equals the sum of the bending moments of the component triangles about point a. Of the numerous elementary triangles we may select the fourth, $a\ d_4\ e_5$, shown shaded in Fig. 9. It is positioned by T_4, the arm length of the fourth step. To depict the bending moment M_{B4} of this triangle about point a, we draw the vertical force arrow Q_4 through the centroid of the triangle, Q_4 representing the area of the triangle. The distance from a to arrow Q_4 equals 2/3 T_4. We then have

$$M_{B4} = 2/3\ Q_4 T_4$$

Investigating the area Q_4 of the fourth triangle $a\ d_4\ e_5$, we observe that the corresponding section $\overline{c_4 c_5}$ on line $\overline{bc_1}$ is

$$Y_4 - Y_5 = V_4,$$

V_4 being the yield value of the fourth step. Then triangle side

$$\frac{d_4 e_5}{} = V_4 \frac{T_4}{A_1}.$$

Hence the triangle area Q_4 is given by the equation

$$Q_4 = 1/2 V_4 \frac{T_4^2}{A_1}$$

Consequently,

$$M_{B4} = \frac{V_4 T_4^3}{3A_1}$$

Generally speaking, we have for the bending moment M_{Bn} of the nth. triangle about point a

$$M_{Bn} = \frac{V_n T_n^3}{3A_1} \quad \ldots\ (XI)$$

The total bending moment M_B of the reloading area equals the sum of the bending moments of all the component triangles. According to the conjugate-beam principle, M_B equals the end deflection of the actual cantilever beam or (what amounts to the same thing) the center deflection of the spring. This center (or end) deflection, which is produced by force P at the center spring, may be designated by f_e. We then have

$$M_B = f_e = \frac{\Sigma V T^3}{3A_1} \quad \ldots\ (XII)$$

From this equation in conjunction with equation (IX) we find for the spring rate R the relation

$$R = \frac{Pe}{f_e} = \frac{2E}{A_1} : \frac{\Sigma V T^3}{3A_1}$$

$$R = \frac{6E}{\Sigma V T^3} \quad \ldots\ (XIII)$$

This equation was given as equation (9) in the Practical Section.

It is of interest to note that in the summation $\Sigma V T^3$ the greatest share is contributed by the last term $V_L T_L^3$ (see sample calculation). If we eliminate all the other terms of the summation, we arrive at a spring rate R_L, expressed by the equation

$$R_L = \frac{6E}{V_L T_L^3} \text{ or } R_L = \frac{6EI_L}{A_1^3}$$

This, as may be readily ascertained, is the rate of a spring in which each leaf extends from the center to both ends. The difference between R_L and R shows how much the spring has been softened by cutting off the ends of the supporting leaves.

Rate of an Unsymmetrical Spring

As a first step in the analysis of an unsymmetrical spring, we consider the relation between its center deflection and its end deflections. "Center" in this connection denotes the center of the spring seat. Correspondingly, the terms "left half" and "right half" of the spring refer to portions of the spring on opposite sides of the spring seat, which, of course, are not equal.

In Fig. 10 NOn represents an unloaded horizontal spring leaf supported at N and n. O is the spring seat and $\overline{NO}$ is longer than $\overline{nO}$. We now apply a vertical concentrated load at O and adjust the ends so that the situation in the immediate neighborhood of O remains unchanged. The result is the curved leaf $N'On'$, having, with reference to the original horizontal position, the vertical end deflections F' (at N') and f' (at n'). The vertical center deflection f is then the vertical distance from O to the connecting line $\overline{N'_n n'}$.

FIG. 10

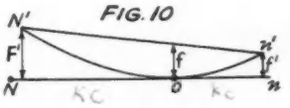


FIG. 11

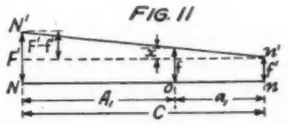
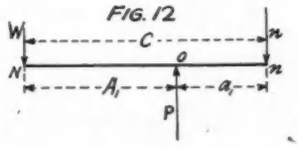


FIG. 12



On the basis of Fig. 10 we can compute the center deflection of a leaf spring, fixed and shackled in the conventional manner, with a high degree of accuracy.

Fig. 11 shows the essential geometrical relations of Fig. 10 in a more developed stage. The total spring length $\overline{Nn}$ equals C, the length of the left half $\overline{ON}$ equals A_1 and that of the right half $\overline{On}$ equals. a_1. The fundamental spring proportions are then expressed by the two equations

$$K = \frac{A_1}{C} \quad \ldots\ (XIV)$$

$$k = \frac{a_1}{C} \quad \ldots\ (XV)$$

Since $K + k = 1$, we have $K = 1 - k$ and $k = 1 - K$.

A horizontal through n' intersects f at a distance x and F' at a distance $F' - f'$ below $\overline{N'n'}$. We have

$$\frac{x}{F' - f'} = \frac{a'}{C} = k$$

$$x = k(F' - f')$$

$$f = f' + k(F' - f') =$$

$$' + kF' - kf' = kF' + (1-k)f$$

$$f = kF' + Kf'$$

$$\text{or } f = \frac{a_1 F' + A_1 f'}{C} \quad \ldots\ (XVI)$$

Next we consider the equilibrium condition of the beam or spring Non, as represented in Fig. 12. The beam, which is supported at O (spring center) by a force P, carries a load W at the left end N and a load w at the right end n. These loads are determined by the equations

$$W = P\frac{a_1}{C} \text{ and } w = P\frac{A_1}{C}$$

Calculating from either end, we find for the maximum bending moment M at the point of support O the same value:

$$M = WA_1 = na_1 = P\frac{A_1 a_1}{C} \quad \ldots\ (XVII)$$

Hence the spring center force P is given in terms of the maximum bending moment M by the following equation:

$$P = \frac{MC}{A_1 a_1} \quad \ldots\ (XVIII)$$

Combining equations (XVI) and (XVIII), we find for the spring rate R_u at the spring center O

$$R_u = \frac{P}{f} = \frac{MC^2}{A_1 a_1 (a_1 F' + A_1 f')}$$

$$= \frac{MC^2}{A_1 a_1^2 F' + a_1 A_1^2 f'}$$

$$R_u = \frac{M}{k^2 A_1 F' + K^2 a_1 f'} \quad \ldots\ (XIX)$$

As in the case of the symmetrical spring, we again choose the spring center force P so that, through the medium of the end forces W and w, the maximum bending moment M becomes equal

to the modulus of elasticity E. If, then, the characteristic "yield-arm length summation" for the left spring-half is represented by ΣVT^3 and for the right spring half by Σvt^3, we know from equation (XII) the values of the end deflections F' and f':

$$F' = \frac{\Sigma VT^3}{3A_1}, f' = \frac{\Sigma vt^3}{3a_1}$$

Substituting these values in equation (XIX), we find

$$R_u = \frac{3E}{k^2\Sigma VT^3 + K^2\Sigma vt^3} \quad . \quad . \quad (XX)$$

This is equation (14) of the Practical Section.

Stresses of a Symmetrical Spring

Having determined the laminal-spring rate R', as explained in the Practical Section, we derive the stresses in the various leaves, due to a certain spring deflection f, by considering an integral plate, equivalent to the leaf spring and having the spring rate R'. Fig. 13 shows one-half of an integral plate for a three-leaf spring. Here the actual spring width B is used for each of the rectangular strips. Consequently, each strip has a different thickness H. The proportions of the thicknesses, as shown, are exaggerated. The strips are arranged symmetrically with reference to a common neutral plane, as shown in the end section. Fig. 13 may be regarded as representing a symmetrical spring possessing a total moment of inertia I_L of all the leaves in the center line X-X (I_L used as in the preceding analysis) and subjected to a central spring force P. We then have in the center section X-X a bending moment

$$M = WA_1 \text{ or } M = \frac{PA_1}{2} \quad \text{(See Fig. 13)}$$

The maximum or border stress in the thickest portion of the plate along line X-X will be

$$S_1 = \frac{MH_1}{2I_L} = \frac{PA_1H_1}{4I_L}$$

The spring rate R', central force P, and central deflection f are connected by the equation $R' = P/f$. Hence $P = R'f$. We then find

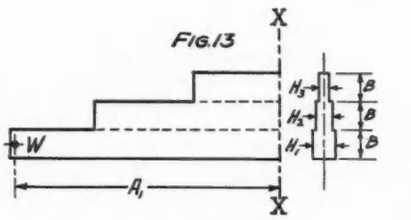
$$S_1 = \frac{R'fA_1H_1}{4I_L} \quad . \quad . \quad . \quad . \quad . \quad (A)$$

This is the stress formula for the main plate. It was given as equation (17) in the Practical Section. The border stress on line X-X of the integral plate is proportional to the thickness of the plate at the particular point. Hence

$$S_2 = S_1\frac{H_2}{H_1} \qquad S_3 = S_1\frac{H_3}{H_1}$$

$$S_4 = S_1\frac{H_4}{H_1} \text{ etc.} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (B)$$

These are the stress formulæ for the successive supporting leaves. They were combined as equation (19) in the Practical Section.



Stresses of an Unsymmetrical Spring

We will now consider Fig. 13 as representing the left half of an unsymmetrical spring, as shown diagrammatically in Fig. 12, line X-X in Fig. 13 coinciding with point O in Fig. 12. Again we have for the border stress S_1 in the thickest portion of the plate along line X-X the relation

$$S_1 = \frac{MH_1}{2I_L}$$

The bending moment M at point O (Fig. 12) due to a central spring force P is given by equation (XVII) as

$$M = P\frac{A_1a_1}{C}.$$

This may also be written in the form

$$M = PC\frac{A_1}{C} \times \frac{a_1}{C}$$

or $M = PCKk$

Hence

$$S_1 = \frac{PCH_1}{2I_L}Kk \quad . \quad . \quad . \quad . \quad . \quad (C)$$

Having previously determined the laminal-spring rate R_u' (see equation 16), we have for a center deflection f (at point O) the relation

$$P = R_u'f$$

Combining this with equation (C), we get

$$S_1 = \frac{R_u'fCH_1}{2I_L}Kk \quad . \quad . \quad . \quad (D)$$

This is the stress formula for the main plate of an unsymmetrical spring. It was given as equation (18) in the Practical Section. Equations (B), giving the stresses in the supporting leaves, apply to an unsymmetrical as well as to a symmetrical spring.

Spring Rates by the Customary Method

For purposes of comparison the usual equations for spring rates of leaf springs will be given. The conventional method of calculation is based on the assumption that the spring is the equivalent of a "diamond plate," that is, a beam of uniform strength. The symbols used here are the same as in the preceding analysis. However, since only the total moment of inertia has to be considered, it is designated by I instead of by I_L.

(A) Spring rate of a symmetrical spring

$$R = \frac{4EI}{A_1^3} = \frac{32EI}{C^3}$$

(Theoretical equation)

Automobile springs, as a rule, owing to the arrangement of their leaves, are considerably stiffer than the "diamond plate" which forms the basis of the above equation. Hence a correction factor of 1.075 is sometimes introduced which makes the corrected spring rate

$$R_c = 1.075R = \frac{4.3EI}{A_1^3} = \frac{34.4EI}{C^3}$$

(Corrected equation)

(B) Spring rate of an unsymmetrical spring

$$R = \frac{2EI}{A_1^3k^2 + a_1^3K^2}$$

(Theoretical equation)

$$R_c = 1.075R = \frac{2.15EI}{A_1^3k^2 + a_1^3K^2}$$

(Corrected equation)

In conclusion it may be pointed out that the two principal equations developed, viz:

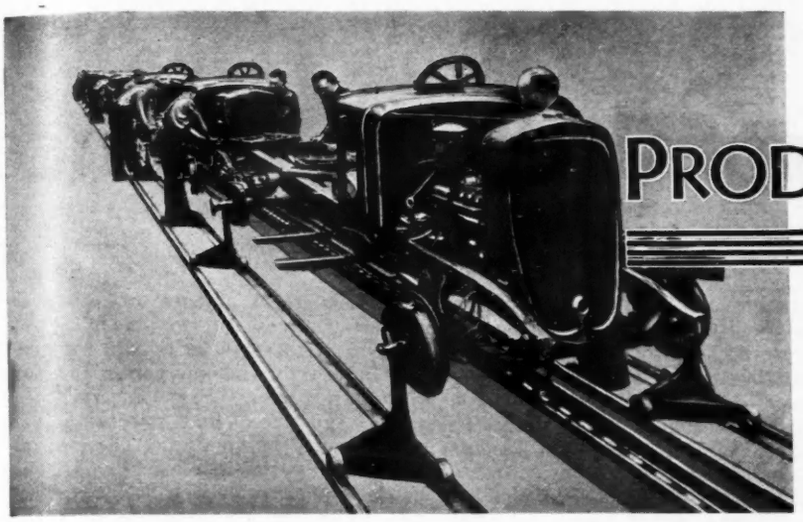
$$R = \frac{6E}{\Sigma VT^3} \text{ and } R_u = \frac{3E}{k^2\Sigma VT^3 + K^2\Sigma vt^3}$$

furnish a handy means of calculating the deflection f, wherever a beam whose cross-section changes stepwise is supported at the ends and carries a single concentrated load P. The deflection f, calculated from the relation $f = P/R$, is the deflection in line with the load P.

New Instrument Measures Aging Rates of Materials

CERTAIN organic materials change in the course of time with respect to physical properties which make them valuable for industrial purposes; in other words, they "age." In most cases this aging process is an oxidizing process. The materials absorb atmospheric oxygen which combines with some of their constituents to form oxides. In the case of lubricating oils, for instance, these oxides, which form particularly at higher temperatures, constitute the familiar crankcase sludge.

In many cases it is desirable to determine the resistance of materials to aging or oxidation in advance. An apparatus designed to permit of determining this characteristic, known as the "Oxydator," has been placed on the market by Herman A. Holz, New York. Data obtained by means of this apparatus are plotted, and a curve is drawn through the points so obtained. It is said to require one hour 40 minutes to obtain the data for a complete aging curve.



PRODUCTION LINES

Tool Electrode

Lincoln Electric is out with something that has appeal in the way of tool maintenance savings. It's an electrode of special tool steel having the same characteristics as high-speed-tool-steel. It can be used on large tool tips such as planer or shaper tools to weld a substantial cutting edge on the end of a mild steel tool, thereby making it unnecessary to make the whole thing of tool steel. Another use is as a "putting-on" tool for restoring worn or broken cutting edges on dies, shears, etc. No heat treating is necessary to develop the properties of the cutting edge after deposition.

Spun Cast

We have just received a bulletin on cylinder liners and spun castings from James & Co., of Halesowen, England. It describes the James method of producing centrifugally cast parts in permanent molds, with some notes on laboratory control. Cylinder liners have been so widely used in Europe that this company carries a complete stock of standardized liners suitable for most of the popular cars and trucks, including those of U. S. manufacture, in service in England.

Well Done

R. H. Coverley of Rolls-Royce, reputed to be pretty much of a mechanical genius in his own right, spent some time in this country last year. During the course of his visits around the automotive circuit he made some observations which formed the basis of a paper which he recently read in England. His paper, "Industrial Conditions in the U. S. A.," stamps his as a keen observer and a capable student of management. His comments are particularly flattering to the management of automotive establishments.

Eighty-Five Years

Allis-Chalmers tells the story of its organization in a new booklet—Eighty-Five Years of Progress. An interesting section of this booklet is devoted to welfare activities. Mutual aid with sick benefits, hospital, relief fund, safety, workmen's compensation, group life insurance, and the Wisconsin unemployment insurance plan, all are available to the workers of this company. This activity gives a bright perspective of what the company has done and is doing to safeguard the comfort and security of its employees.

Tire Facts

Goodrich has brought out the 1935 edition of the popular "Operators Hand Book." This one is intended for users of trucks, buses, and tractors. Among the things covered are —tire selection, load analysis, determination of tire cost per mile. Undoubtedly this little book should be of practical value to operators as well as engineers.

Group Drives

Modern group drive for production equipment holds an interesting story for the plant executive. You will find it well told in an unusual booklet—"Industrial Power Transmission"—published by the Mechanical Power Engineers Association. It takes up flow lines, quality, lighting, efficiency, power factor, and many other phases of plant economics. It's free for the asking.

Monographs

Standard Oil of Indiana has just started what to us seems an invaluable service to industry. It consists of the development and distribution of technical monographs on the myriad aspects of industrial lubrication. No sales talk, as these booklets are the product of the Technical Staff, but real practical as well as scientific discussion of lubrication problems and their solution. Of the monographs published so far, you may be most interested in the one titled, "The Lubrication Engineer." Four or five booklets will be released each month. We'll get you on the mailing list.

Big Question

Some of the people in Detroit are much concerned about the production of clutch plates perfect enough to do the right kind of job. And it is a problem to fabricate and heat treat a large thin disc without a wave or buckle in it. Several clutch makers, at least, have established a reputation for doing the job in most acceptable fashion.

Steel Specs

A folder listing the revised S.A.E. steel specifications (chemical composition) has just reached our desk. It gives the official dope on standards which became effective in January, 1935. The folder is made available to those interested, through the courtesy of Republic Steel Corp.—J. G.

The Economic Consequences

CAN industry stand the increased cost burden — the 30-hr. week? Will labor actually derive all the benefits outlined as the basis for the change? How will such a development affect our national recovery?

To what extent will a reduction in hours per man per week affect production and production schedules? By probing below the surface indications, it is possible for one to get the answer to this question.

A general reduction in the number of hours of each worker during a week will, under conditions which exist, correspondingly reduce the production of that worker. In many fields there are not enough skilled or semi-skilled workers available to replace or make up for the reduction in number of working hours. In such cases the only possible outcome will be a reduction in output proportionate to the reduction in working hours. In the long run this might be overcome to some degree through technological improvements.

At the present time consumer goods industries have reemployed a much larger proportion of workers on the 1929 basis than have other branches of industry. A few individual industries, i.e., cotton textile industry, paper industry, meat-packing industry, and the chemical industry†, are actually at the present time employing as many or more workers than in the boom period of 1929. Should the proposed legislation go into effect, where would these particular industries turn for their skilled workers? They would of necessity have to employ men unfamiliar with the jobs to be done. Production costs would naturally increase, not only because of increased payrolls but because of the waste and inefficiency of the additional workers. Production schedules could never be maintained by less-skilled or less-efficient employees.

Furthermore, a flat reduction of working hours would cause tremendously difficult operating problems. Concerns, frequently, would not be able to maintain their present production on a single shift of six hours, while the volume of their business would not justify two shifts of six hours, or even justify their operating on one full shift and one part shift. Likewise, many two-shift industries might find it impracticable to operate on three shifts. It goes without saying that the production of such industries would be completely dislocated.

† U. S. Bureau of Labor Statistics.

A Barrier to Recovery

Were industry to be faced with the possibility of a readjustment in hours alone, there is the possibility that the added cost burden might be overcome through technological advances and such increases in efficiency as might possibly materialize through the adoption of the shorter working day. However, industry, under the proposed legislation, will be harassed with additional expenses due to the maintenance of the present basic week rate for wages. The combination of the two will be an impossible barrier for business to hurdle.

Regardless of the fact that proponents of the 30-hr. week hold that by distributing employment, increased costs of industry will be absorbed by increased purchasing power of the mass of people, the facts do not so indicate. Costs will not increase proportionately with increased payrolls. In most instances labor costs will have advanced much more rapidly and to a considerably greater extent than payrolls. Therefore if prices are to cover costs and still give an adequate return on investments, they must be increased to a point which will cover not only the increased payrolls but the increased costs which are supplemental to the reduction in working hours. Total payrolls, in other words, will not represent the same total amount of goods as hitherto. Those classes of labor not covered by this legislation will not have any added purchasing power to meet increased prices. Farm incomes will not be advanced and purchases will consequently be smaller. The general effect will be, not increased demand for goods but, conversely, a decided reduction in the demand for consumer goods. If prices are reduced in an attempt to stimulate demand, gross incomes will fall.

Reciprocal international trade agreements and their underlying theories have been receiving added attention in governmental and industrial circles during the past year or so. Logically, if we want to promote our foreign trade we must maintain our prices on a plane which compares favorably with existing prices abroad. Entrepreneurs will be forced to seek more for their products if labor costs are advanced, consequently any advantages gained through reciprocal trade agreements will have been voided, and any slight improvement noted in our balance of trade will have been wiped out, and, more directly, any increases in income derived from the sale of American products in foreign markets will have been denied manufacturers.

It has been said of the depression that marginal producers have been eliminated and only the more strongly financed and economically operated companies in various industries are able to continue to function. What actually is the case is that those producers who were formerly considered strong both financially and managerially have now dropped to the class of the marginal producer. In any competitive market, no matter how many component parts, there will always be the marginal producer.

In the interests of reemployment, can industry at the present time reduce its numbers by eliminating those producers who were previously considered to be on a firm basis but who have since become marginal because of increased costs in combination with a steady falling off in demand for their products? Most editors of business papers believe this is not the time to reduce any agencies which can and should employ workers. Such eliminations can bring no benefits and they will accentuate any and every economic problem which is facing the country at the present time. It appears that a blanket 30-hr. week would be likely to bankrupt every marginal producer now existing in our economic system.

s of the 30-Hour Week*

It has been mentioned before that the proposed labor legislation will not increase demand for goods to the extent anticipated. Companies, other than those now marginal, will find their incomes cut and their profits reduced. Current reports point out that industry in general has by no means come out of the depression. While there are a few more individual enterprises showing small profits than there were a year ago, the total income of industry has not advanced appreciably. The margin of profit is very narrow, where it exists at all, and vast sections of industry are still operating in the red and have been so operating for several years.

The primary object behind the sponsoring of the proposed legislation is the ultimate employment of a greater portion of those now unemployed and a generally improved status of labor through an increased standard of living. But could these desiderata logically be expected to develop from the proposals of the Black-Connery Bill?

It stands to reason that any flat reduction in the productivity of individual workmen will necessarily bring a flat reduction in the return to those same workmen. Legislation may demand increased wages for reduced productivity, but the condition of industry in the long run will be the determining factor. Corporations will not be able to maintain an advanced wage rate in the face of falling incomes. Reductions in working hours from 50 or more per week to 40 were possible, as has been shown by the experience of industry during the past year or year and a half. However, the law of diminishing returns enters the calculation at some point and it seems to be the belief of most economists that we are now at, or perhaps have passed, the point at which industry can get the greatest productivity out of labor and labor can get the greatest return for its productivity.

At no time, apparently, do proponents of the proposed legislation concede the fact that a reduction in working hours will, at a basic week wage identical with prevailing weekly wage rates, buy substantially smaller quantities of goods because of the higher prices that entrepreneurs will be forced to ask for their products.

In a statement made by the Retailers National Council to the Subcommittee of the Senate Judiciary Committee on the Black Thirty Hour Bill is included a list of goods commonly known as essentials with then current prices and prices at which they would have to be sold should the 30-hr. week become effective. The list follows:

	Now Selling for	Will Have to Sell for
Coffee—No. 4 Santos	$0.19	$0.23
Rice	.07	.09
Macaroni	.09	.12
Butter	.40	.49
Round steak	.24	.30
Standard package breakfast food	.09	.12
Overalls	1.29	1.65
Work shirt	.75	.98
Work trousers	2.98	3.79
Work socks	.19	.25
Men's work shoes	2.50	3.25
Canvas gloves	.20	.25
Comforters	2.98	3.79
Mattresses	8.95	11.95
Metal bedsteads	8.00	10.00
Curtains	1.00	1.29

The committee stated: "As a result, if this bill becomes a law, the consuming public will be required to pay at least 25 per cent more for all classes of consumer goods than at the present time. There is room for very great doubt that the consuming public will buy as many goods at these higher prices as they are buying now. If they do not, the total volume of goods sold, the total volume of goods produced and the demand for labor will decline."

Real Wages Lower

It is easy to see, therefore, that wages, that is, real wages, will be substantially reduced because of the higher prices required to meet the additional labor costs. It will not only be real wages, however, but actual money wages, which will be reduced in the long run. Manufacturers will maintain production schedules just so long as there is a constant demand for the goods produced. Workers will not be able to purchase the same quantity of goods as heretofore. This is true of almost every group in our population. The net result must be a reduction in output. While this does not necessarily mean a reduction in the number of men employed, it is probable that it will have that effect. It will definitely mean a reduction in the number of hours of employment.

For reasons entirely beyond the control of industry the demand for certain products is very unevenly distributed throughout the year. The nature of the individual product often precludes the possibility of its being stored, while at the same time it is often necessary for consumers to make their purchases on a short time basis only. The combination of these two factors brings about great seasonal fluctuation in production and consequently in employment.

Where there are substantial seasonal fluctuations in employment it is to be noted that even during depression years a great portion of the available labor is employed during the peak season, even if the duration of that employment is much shorter than it would be were conditions normal.

Peak seasons generally last only a few months and then fall off to average or less than average during slack seasons. What is to become of the workers thus relieved of employment? How are they to be affected by the provisions of the Black-Connery Bill?

The variations between the number employed during slack seasons and peak seasons are going to be accentuated tremendously in industries affected by seasonal production, such as coal, automotive, lumber, steel and many in allied fields.

If labor were free to move to wherever it was in demand, this prob-

*Abstract of a report by the Committee on Labor Problems of the National Conference of Business Paper Editors. Copies of the complete report at 10 cents each may be obtained from the Associated Business Papers, Inc., 330 West 42nd St., New York, N. Y.

lem would have less importance. Experience has shown, however, that labor does not flow readily to points of demand. The reasons for this are obvious. Family ties and home ownerships all tend to restrict the free movement of labor. Any tendency to increase the demand for seasonal labor overnight will throw a wrench into the machinery of production. Labor will not be able to meet the demands placed upon it and management will have to turn very largely to unskilled or semi-skilled workers to do the work of skilled men in industries where production varies to any great extent from one season to another.

The proposed legislation works at direct cross purposes with the government's agricultural program. Efforts are now being made and have been made during the past few years to bring about a better adjustment between agriculture and industry through raising the prices of farm commodities relatively to the prices of industrial products. The thirty-hour week bill would certainly defeat this objective.

It is not at all unlikely that farm labor would be attracted to various cities and industrial centers in large numbers by the mirage of a short work week and high wages. Farm costs would of necessity be raised as the farmers would have to compete with industry in order to hold wage earners.

Productivity and Wages per Worker, 1899-1931

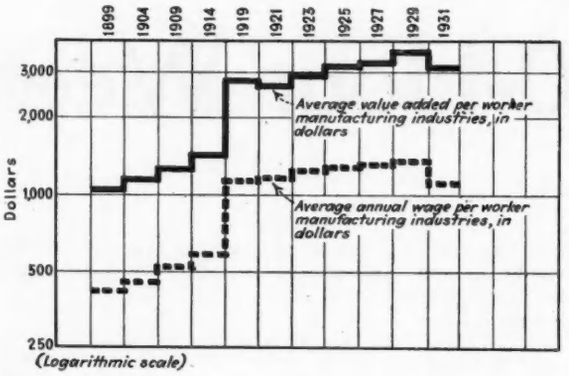


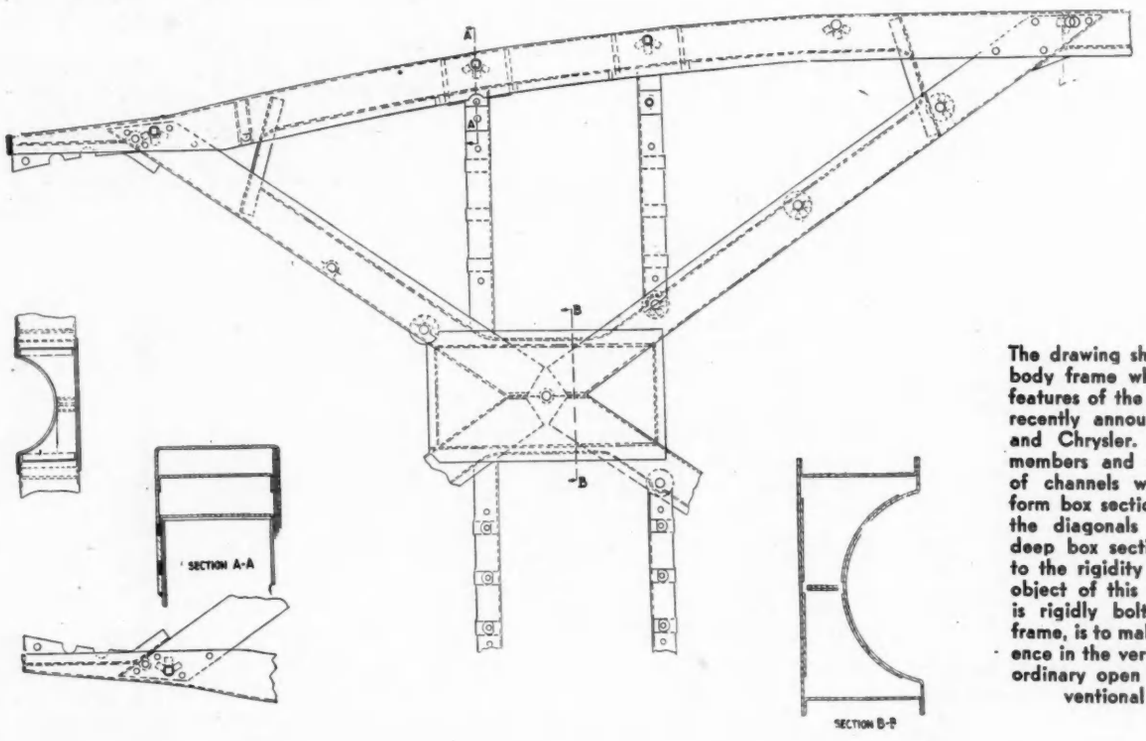
Figure 1—Regardless of business cycles, changing price levels, legislative tinkering, union activities, or industrial efforts, the annual wage per average worker is proportionate to the average productivity per worker.

Based on research of The Eddy-Rucker-Nickels Co.

Almost 100 per cent of industry is of the opinion that any further reduction in working hours bids well to intensify the depression. While a 30-hr. law might have a momentary effect of spreading employment, it would only do so at the expense of efficiency and productive output. A consideration of the proposal offers to workers a choice between more leisure time and a more abundant consumption of goods and services. It has already been shown that under the proposed Act, purchasing power of the individual wage earner will decline proportionately to the increase in production costs brought about by the reduction in working hours. In other words, a decline in the general standard of living is not at all unlikely.

Under normal conditions, recovery of industry after a depression is brought about by the restoration of confidence through a reasonable prospect of profits. Without this incentive and assurance entrepreneurs will not advance on new ventures. Without it, there can be no recovery. In any society where there is a falling standard of living, there is a decreasing demand for goods, which in turn calls for a reduction in the number employed in the production of goods or the performance of services.

Closed Car Stiffness in Open Car Bodies



The drawing shown here is of the body frame which is one of the features of the convertible coupes recently announced by Plymouth and Chrysler. It comprises side members and diagonals built up of channels welded together to form box sections. At the center the diagonals are welded to a deep box section to further add to the rigidity of the frame. The object of this body frame, which is rigidly bolted to the chassis frame, is to make up for the difference in the vertical stiffness of the ordinary open body and the conventional closed body.

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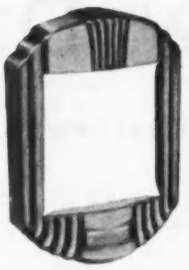
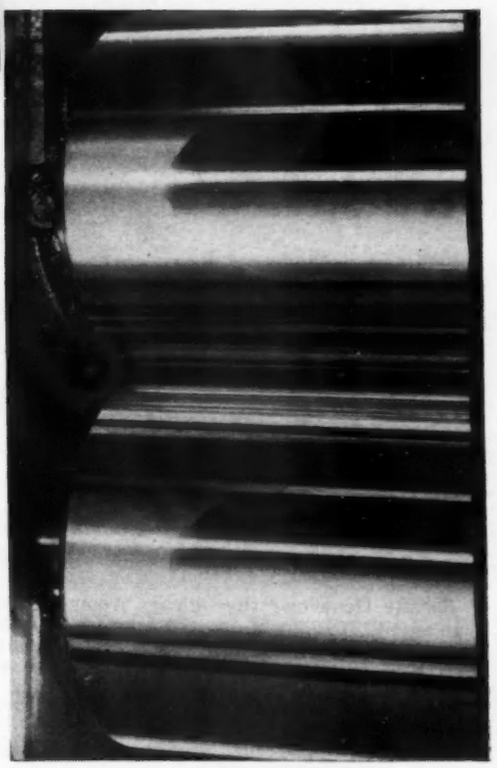


● *Automobile heater shell, made from cold rolled No. 3 finish Acme Superstrip, for chrome or nickel plating. Not only is an exceptional finish required for this job, but the quality of the steel must permit particularly severe drawing for the formation of the ribs.*

● *Mirror-like rolls give Acme cold rolled Superstrip a mirror-like finish.*



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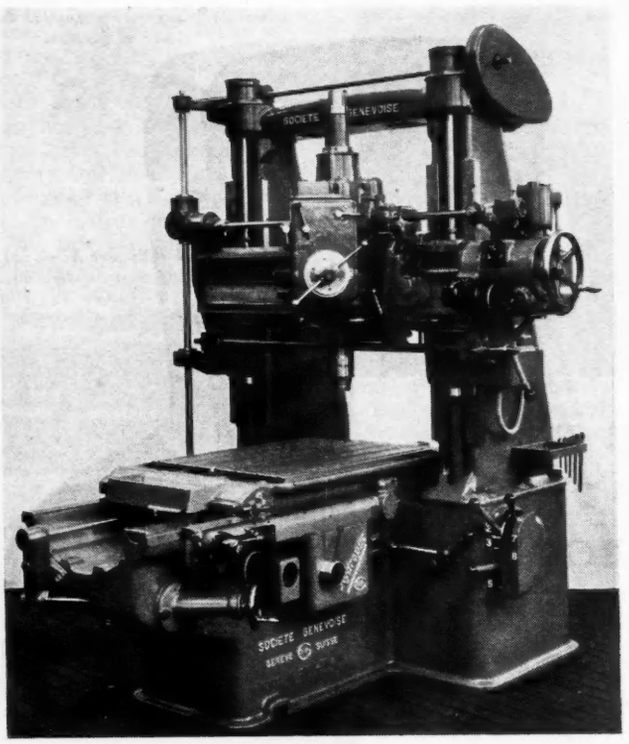


Hydroptic Miller and Jig Borer

Societe Genevoise through its American agents, Triplex Machine Tool Corp., New York, N. Y., has introduced a new SIP combined jig borer and milling machine—the Hydroptic Size A. The machine has been designed specifically for direct production work, experimental work, and jig making, and other applications where great precision is required. It features hydraulic table feed and an optical method scale reading within an accuracy of 0.0001 in. and accuracy of setting within 0.0002 in.

Considerable saving in set-up time is assured on the "Hydroptic" machine by hydraulic traverse of the table. This drive provides instantaneous and wide variations of speed between 0.2 and 80 inches per minute. A number of interesting features for this hydraulic feed have been developed, providing slow hand motion for fine setting purposes, the connecting of the hand locking of the table on the bed ways to a device releasing the hydraulic pressure, and proper adjustment of the table speed. Efficient protection prevents the table ways from being soiled by dirt and dust. The Vee and flat ways are always fully guarded.

The cross motion of the spindle head is controlled by a new patented combination of a very rapid hand drive with an electrical power drive, the latter being used for milling purposes, while the former provides for quick traverse. The novelty is that both drives are always in mesh, and available without any selecting operation, thus when milling a casting provided with bosses to be machined, the spindle can be quickly traversed from one boss to the other, by turning only the handwheel without disengaging the power drive. A slow hand feed is always in mesh for setting purpose.

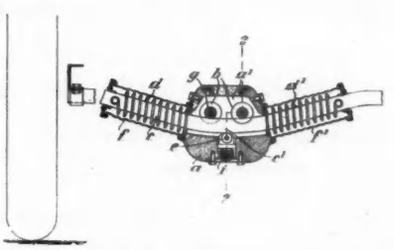
All clamps are controlled from the operating side of the machine. The table is locked to the bed during boring. A single lever operates a two-point acting self-compensating clamp for locking the spindle saddle on the cross-rail. Another lever operates a four-point acting self-compensating clamp for locking the cross rail to the uprights.

Inertia Used to Stop Skidding

A NOVEL type of skid preventer has been developed by a German engineer, F. Hanel. As shown by the diagrammatic drawing reproduced herewith, he places a downwardly curved track across the rear of the chassis frame, at the center of which there is a slidable weight. The weight is mounted between two light coiled springs and is guided on the track by means of three rollers.

When the rear wheels start to skid sideways, the anti-skid weight, owing to its inertia, stays behind, which compels it to mount the track. The weight is then accelerated in a direction substantially perpendicular to the track, and as a result there is a reaction of the weight on the track which is also perpendicular to the track. A component of this reaction is parallel with the axle in the direction opposite to that in which the wheels are skidding, and evidently tends to stop the skid. It is stated that a weight equal to about 3 per cent of the weight of the car has been found adequate to kill an incipient skid.

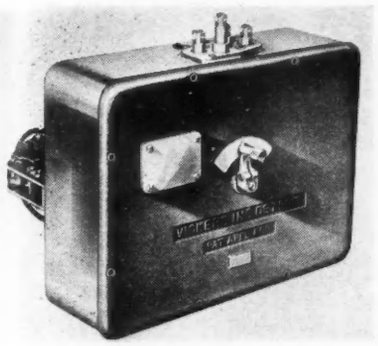
Patents on this device have been



issued in Germany and in this country. Mr. Hanel is represented here by George Kroto of New Rochelle, N. Y.

New Vickers Control Panel

Vickers Incorporated, Detroit, Mich., has placed on the market an electric-hydraulic control panel, making available a great variety of combinations of automatic feeds and rapid traverses for



machine tool elements and other kinds of mechanical equipment.

Starting, reversing and stopping are controlled electrically by push buttons or limit switches, relays and solenoids built into the control panel. A synchronous time relay which is easily varied by simply turning a dial in panel, provides delayed reverse. The different feed rates and rapid traverses are controlled hydraulically, being increased or decreased by stops (on work table) that depress one or the other of the two center plungers. Length of any working stroke or rapid traverse is varied at any time by simply changing position of stops. Lever provides manual control for set-up purposes. Changes in work resistance or operating pressure of hydraulic system do not affect feed rates; consequently tool jumping and overfeeding are prevented.

Panel provides complete hydraulic circuit except pump and cylinder; it is flush mounted with gasket and requires no pipe connections. It saves space, improves appearance, reduces piping and is easily applied. It is available in several types and sizes.

Automatic Lubrication for Conveyor Trolleys

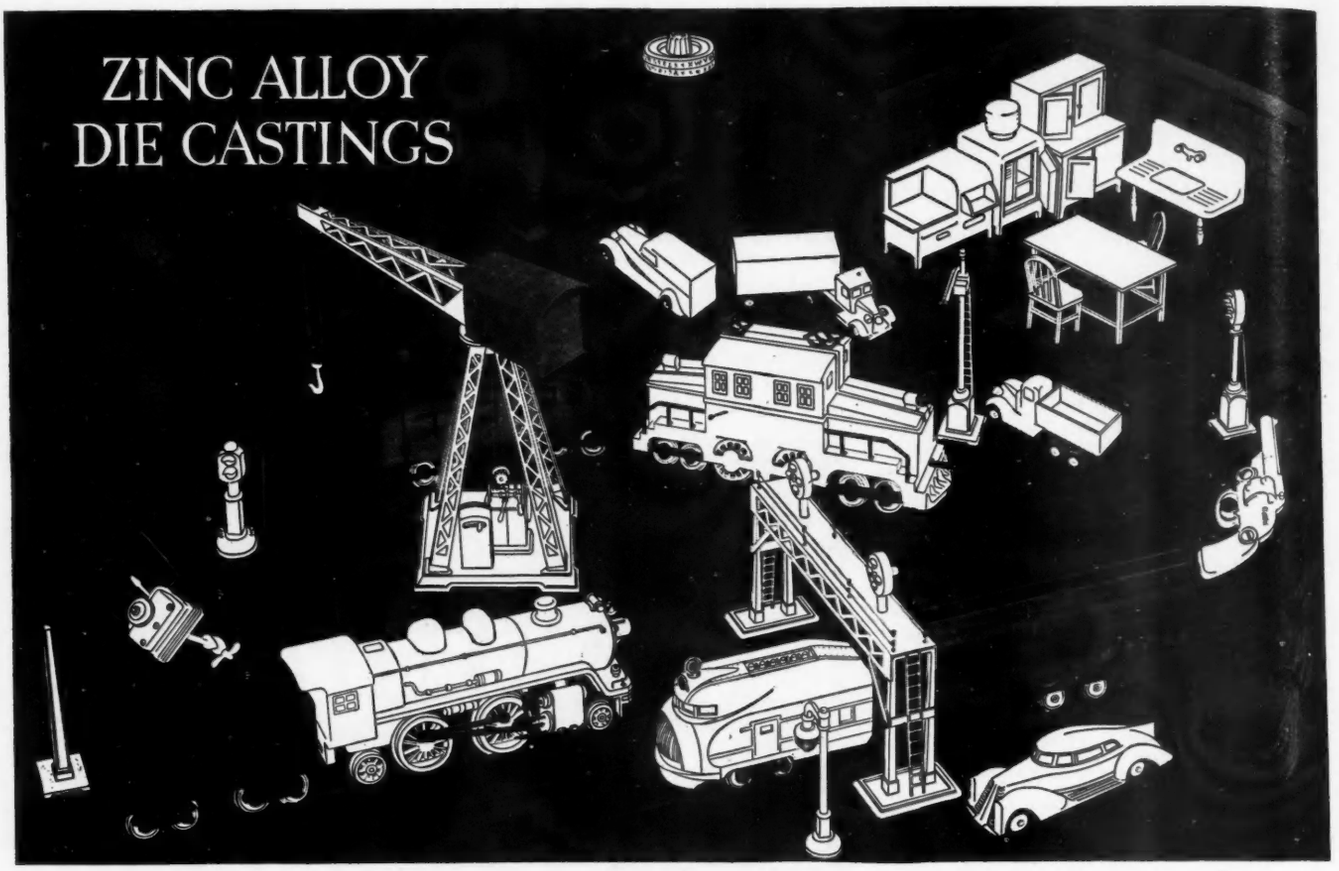
Correct and economical lubrication of the trolley bearings of overhead trolley conveyors has long presented a problem. This is especially true when the conveyor passes through enamel ovens, which tend to cake the lubricant, or through washing machines where lubricent is broken down and washed out, making necessary repeated application of lubricants.

To overcome these difficulties a Detroit engineer, F. Bjerre, designed a pneumatic trolley lubricator which is being marketed by the J. N. Fauver Company, lubrication specialists, Detroit, Mich. Plant air pressure is reduced by a standard Norgren reducing valve to operating pressure. The air then passes through a Norgren air line lubricator which introduces into the air stream, a drop at a time, lubricating oil of the proper viscosity. Thus a fog of oil leaves the air line lubricator and is applied under air pressure to the trolley bearings. The bearing lubricator consists of a unit attached by four machine screws to the top of the conveyor rail.

As each trolley passes under the lubricator, it trips a pair of triggers which automatically (by actuating the blow valve) releases jets of fogged oil, forcing the lubricant directly into the bearings. Air pressure, oil volume and direction of jets are readily adjustable. The energy required to operate the device is supplied by the moving trolley. Oil storage capacity of 1½ pints. The device is claimed to reduce the cost of labor and oil, to eliminate dripping, to eliminate trolley break-downs.

Improved Lift Truck of Lyon

An improved model of the hydraulic lift truck which has been supplied during the past few years is announced by the Lyon Iron Works, Greene, N. Y. It is supplied in three standard sizes, namely, 3500 lb., 5000 lb. and 6000 lb. The frame is of angle iron; Timken roller bearings in the front wheels. It is equipped with an improved air vent which prevents the leakage of oil when the truck is turned over for greasing and inspection.



A TIP FROM THE TOYS

Perfect reproduction of details is the important factor in many parts, in many products... perfect reproduction by an economic method. Some of the outstanding toy manufacturers have solved these problems with ZINC Alloy Die Castings.

The electric locomotives are practically scale models of the locomotives they represent, reproducing in clear-cut fashion the smallest details of external appearance. The die cast surfaces are clean, smooth and dense so that finishing them in either organic or metallic coatings is accomplished with a minimum of labor.

If you have run into these same problems in the manufacture of the parts which go into the assembly of your products, take a tip from these toys. ZINC Alloy Die Castings answer many of these problems with true economy.

The ZINC Alloy Die Cast toys shown in the above illustration are:

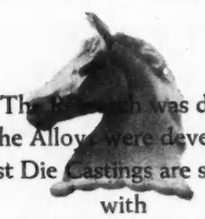
Electric locomotives of the steam, electric, and stream line diesel types

Semaphore and light signals for the electric trains

Trucks and a stream lined coupe

An outboard motor — Household furnishings

A cap pistol — A typewriter — An electric crane



The Research which was done
The Alloys were developed
Most Die Castings are specified
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